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ANALYSIS OF SULFUR DIOXIDE EXCESSES IN THE WIDOWS CREEK STEAM PLANT AREA DURING 1979

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AIR RESOURCES PROGRAM

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TENNESSEE VALLEY AUTHORITY

Office of Natural Resources

Air Resources Program

ANALYSIS OF SULFUR DIOXIDE EXCESSES IN THE WIDOWS CREEK STEAM PLANT AREA DURING 1979

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CONTENTS

	Page
Scope and Objectives	1
Physical and Environmental Factors	3
Widows Creek Steam Plant Vicinity	3
Ambient Air Quality Monitoring	3
Survey of SO_2 Emission Sources	6
Meteorological Factors	7
Nature of the Excesses	8
Assessment of Probable Contributors	9
Potential Sources	9
Probable Impacts of Potential Sources	9
Analysis of Individual Excesses	13
Conclusions	17
Appendix A: Ambient SO_2 Data Concentration Data	21
Appendix B: SO_2 Emissions Data	43
Appendix C: Meteorological Data	49
Appendix D: Calculations	79

ANALYSIS OF SULFUR DIOXIDE EXCESSES IN THE WIDOWS CREEK STEAM PLANT AREA DURING 1979

SCOPE AND OBJECTIVES

During 1979, SO_2 levels in excess of primary and secondary National Ambient Air Quality Standards (NAAQS)[1] were measured at several monitoring stations in the vicinity of Widows Creek Steam Plant. SO_2 concentrations exceeding the 24-hour primary standard of 0.14 ppm were measured on one occasion at each of two different monitoring stations. No violations of the primary standard occurred. SO_2 concentrations exceeding the 3-hour secondary standard of 0.50 ppm were measured on six occasions at four different monitoring stations. Two violations of the secondary standard occurred.

Excess measurements at Widows Creek Steam Plant during 1979 are important because they represent a sharp increase over the number of excesses (one) measured in 1978. This occurred despite no significant changes in steam plant configuration or SO_2 emissions. Although Widows Creek Steam Plant was in compliance with interim SO_2 emission standards (but not in compliance with the 1.2 lbs/10^6 Btu final SO_2 emission standard) established by the TVA Consent Decree, measurement of ambient SO_2 excesses was not unexpected;[2] however, the sharp increase in number of excesses over 1978 is significant.

The purpose of this report is to examine the physical and environmental circumstances associated with these excess measurements, document the circumstances, and determine the sources which may have contributed to the excess measurements. Data bases utilized in this investigation included: TVA meteorological and air quality data from the Widows Creek monitoring network, National Weather Service (NWS) data, topographic maps, and Widows Creek plant operational data. This report presents and evaluates all available data and information related to the 1979 measurements.

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1. For sulfur dioxide, the primary standard (for protection of public health) is 0.14 ppm for a 24-hour average; the secondary standard (for protection of public welfare) is 0.50 ppm for a 3-hour average. These standards are not to be exceeded more than once per year.

2. During 1978, weighted average annual SO_2 emissions were 3.3 lbs/10^6 Btu and during 1979, weighted average annual SO_2 emissions were 3.2 lbs/10^6 Btu.

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PHYSICAL AND ENVIRONMENTAL FACTORS

This section discusses the relevant physical and environmental factors which include the: (1) Widows Creek Steam Plant environment, (2) meteorological and air quality monitoring data, and (3) emissions from sources with the potential to impact affected monitoring stations.

WIDOWS CREEK STEAM PLANT VICINITY

Widows Creek Steam Plant is located on the Tennessee River in extreme northeast Alabama, approximately 8 km southwest of Bridgeport and 8 km north-northeast of Stevenson, Alabama.

In general, the terrain forms a valley approximately 10 km across with "walls" about 270 m high. The Tennessee river is located along the southeast edge of the valley with the steam plant located along the northwest shore, 191 m above sea-level.[3] Along the opposite (southeast) shore, a steep escarpment (Sand Mountain) rises to approximately 265 m above steam plant grade within 3 km of the plant. From the top of the escarpment, a generally flat plateau extends to the southeast for several kilometers. This escarpment lies along a generally straight line from southwest to northeast, with a single major cove breaking the line of the escarpment about 5 km east-northeast of the plant. To the northwest, the terrain does not follow as straight a line as Sand Mountain as it also rises to heights of 265 m above plant grade (Cumberland Plateau) at distances of 7 km from the plant and beyond. Figure 1 is a sketch of the significant topography in the Widows Creek Steam Plant vicinity.

AMBIENT AIR QUALITY MONITORING

TVA operates a network of fourteen sulfur dioxide (SO_2) monitors in the vicinity of Widows Creek Steam Plant (figure 1). SO_2 is continuously monitored coulometrically with a Philips PW-9700 ambient monitor.

Ambient SO_2 Excesses

During 1979, SO_2 concentrations in excess of the primary ambient air quality standard were measured on two occasions.

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3. For the remainder of this report, all elevation data will be with respect to Widows Creek Steam Plant elevation. That is, all elevations will be actual elevation above sea-level minus the Widows Creek elevation (191 m).

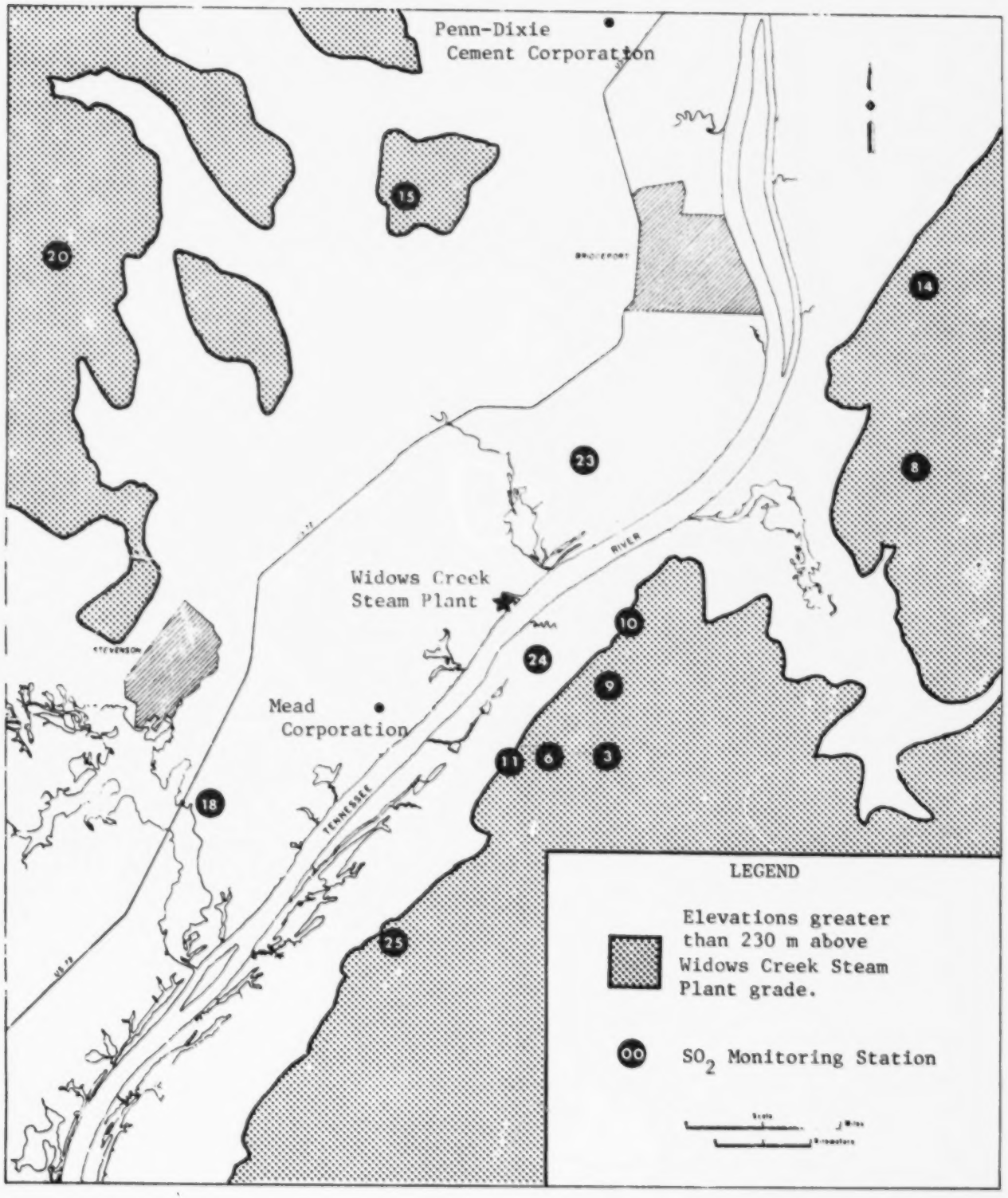

Figure 1. Significant Topography in The Widows Creek Steam Plant Vicinity.

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Date	Ending Time	Monitoring Station	24-hour Average SO_2 Concentration (ppm)
July 27, 1979	1700 CDT	14	0.15
December 27,1979	1000 CST	25	.15

Also during 1979, SO_2 concentrations in excess of the secondary ambient air quality standard were measured on six occasions.

Date	Ending Time	Monitoring Station	3-hour Average SO_2 Concentration (ppm)
April 30, 1979	0900 CDT	11	0.55
July 1, 1979	0900 CDT	14	.54
July 30, 1979	0600 CDT	11	.90
August 15, 1979	0600 CDT	25	.58
November 18, 1979	1100 CST	9	.61
December 27, 1979	0300 CST	25	.59

Complete listings of SO_2 concentrations for these periods are included in Appendix A.

Station Descriptions

Station 9--Station 9 is located in a rural area 3.5 km east-southeast of the steam plant at an azimuth of 118°. The site is a pasture with a ground slope essentially level. The station is approached by a gravel private drive 2 m to the east. Within 200 m surrounding the site there is no heavy or light industry, housing is light, and land use is 10 percent forest, 15 percent agriculture, 55 percent pasture, 5 percent orchard, and 15 percent other.[4] There are no trees or tall obstacles that do not meet the minimum distance criteria for monitoring of this site. This monitoring station meets the SLAMS[5] SO_2 monitor site selection criteria.

Station 11--Station 11 is located in a rural area 3.2 km south-southeast of the steam plant at an azimuth of 166°. The site is a pasture near the escarpment of Sand Mountain with a ground slope of approximately five

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4. The area within 200 m is subjectively examined to determine if there are any extremely local sources of interference which might affect the monitor. Housing is defined as light for a rural area to heavy for a dense suburban area.

5. SLAMS: State and Local Air Monitoring Station siting criteria. These criteria have been established as part of standardized air monitoring guidelines for monitor location, data collection and processing, and instrument calibration. 40 CFR Part 58. "Ambient Air Quality Surveillance."

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percent to the east and south. The top of the escarpment is about 30-50 m to the southwest-northeast. The station is approached by a gravel private drive 1 m to the north. Within 200 m surrounding the site there is no heavy or light industry, housing is light, and land use is 30 percent forest, 50 percent pasture, and 20 percent other. There are no trees, tall obstacles, roads (paved or unpaved), or agricultural activities that do not meet the minimum distance criteria for monitoring at this site. This monitoring station meets the SLAMS SO_2 monitor site selection criteria.

Station 14--Station 14 is located in a rural area 10.6 km northeast of the steam plant at an azimuth of 54°. The site is a pasture with a ground slope of approximately five percent from west to east. The station is approached by a paved road 30 m to the east. Within 200 m surrounding the site there is no heavy or light industry, housing is light, and land use is 30 percent forest, 2 percent agriculture, 58 percent pasture, and 10 percent other. There are no trees or tall obstacles that do not meet the minimum distance criteria for monitoring at this site. This monitoring station meets the SLAMS SO_2 monitor site selection criteria.

Station 25--Station 25 is located in a rural area 7.3 km south-southwest of the steam plant at an azimuth of 192°. The site is a pasture with a ground slope of approximately five percent from west to east. The station is approached by a gravel private drive 3 m to the southeast. Within 200 m surrounding the site there is no heavy or light industry, housing is light, and land use is 5 percent forest, 5 percent agriculture, 70 percent pasture, 5 percent orchard, 15 percent other. There are no tall obstacles that do not meet the minimum distance criteria for monitoring at this site. This monitoring station did not meet the SLAMS SO_2 monitor site selection criteria; there was a single fruit tree about 19 meters to the north which might have a slight filtering effect.

SURVEY OF SO_2 EMISSION SOURCES

Several area and point sources of SO_2 exist which could conceivably impact the Widows Creek monitoring network. A list of the major point sources of SO_2 is presented in Appendix B.

Widows Creek Steam Plant--Widows Creek Steam Plant consists of eight coal-fired units which exhaust flue gases through one 305-m and two 151-m stacks. It has a rated capacity of 1980 MW and is the largest emitter of SO_2 in the vicinity with allowable emissions of 3010 g/sec. Appendix B contains information related to plant operations and actual SO_2 emissions.

Other Nearby Point Sources--Only two other major SO_2 point sources exist in the vicinity. Mead Corporation, which is located 3.7 kilometers southwest of Widows Creek Steam Plant, has allowable SO_2 emissions of 54 g/sec. Penn-Dixie Cement Corporation, which is located 13 km north of Widows Creek Steam Plant, has allowable SO_2 emissions of 56 g/sec.

Nearby Area Sources--Area sources of SO_2 include residential heating, commercial/institutional fuel usage (primarily heating), and open burning. In general, these emissions are population related and result from combustion of sulfur containing fuels. Major industrial point sources are not included when determining area source emissions. It is estimated that SO_2 emissions from the city of Stevenson and Bridgeport are approximately 3 g/sec each.

Major Distant Sources--Numerous point and area sources are located in or near Chattanooga and South Pittsburg, Tennessee; and Huntsville and Scottsboro, Alabama. However, these sources are generally too distant to influence the Widows Creek vicinity except on an infrequent basis.

METEOROLOGICAL FACTORS

This section summarizes meteorological conditions related to the 1979 Widows Creek SO_2 excesses in general terms only. A more detailed discussion of meteorology conditions is included in appendix C. The meteorological conditions for the excess periods can be divided into three general categories based on probable plume characteristics--inversion breakup, fanning, and coning.

Inversion Breakup

Three excess periods fall into this category--April 30, July 1, and November 18, 1979. In each of these cases, a surface-based inversion extended more than 350 m above the surface. The plume was embedded in this inversion layer and remained fairly compact during the predawn hours. As solar heating increased, the lower layers were heated and very unstable mixing conditions occured through a progressively deeper layer. When the layer became deep enough to reach the plume (at about 0700-0900), thermal turbulence brought portions of the plume to the ground, resulting in higher SO_2 concentrations at ground level.

Fanning

Three excess periods fall into this category--July 30, August 15, and December 27, 1979. In each of the cases, a surface-based inversion extended more than 350 m above the surface. The plume was embedded in this inversion and remained compact throughout the excess period. Terrain in the vicinity of the steam plant is high enough that the plume could have impacted directly at ground level when winds were from the proper direction to transport the source plume towards the high terrain.

Coning

One excess period falls into this category - July 27, 1979. This is the only case not involving a surface-based inversion (extending above tower top). Overcast skies prevented solar radiation from reaching the ground and normal nocturnal cooling from occurring. This resulted in slightly stable conditions through the layer above tower top. High terrain enabled the plume to impact nearer the centerline and not just from the lower fringes of the plume.

NATURE OF THE EXCESSES

There are several forms an excess might take. An excess at one site might represent the maximum elevated concentrations observed at all or a number of sites in a network. Alternatively, it could be an isolated event which affects one monitor, but not any of the others. The persistence of high concentrations during an excess must also be considered. The nature of an excess--spatial distribution and persistence of high concentrations--is important when attempting to identify sources which might be responsible.

All of the excesses occurred at monitors on high terrain, while winds were generally blowing from the valley. Effects of plume rise above the surface were somewhat negated by the differences in elevation between sources in the valley and monitoring stations. The high peak concentrations (greater than 1.50 ppm) measured in most cases, is indicative of concentrations relatively close to a large source plume centerline (within 400 meters). The relative isolation of each excess--indicated by high concentrations of a single monitor or several closely spaced monitors--is characteristic of a relatively narrow plume. Therefore, it is probable that all of these excesses resulted due to emissions from a single point source rather than several point or area sources.

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ASSESSMENT OF PROBABLE CONTRIBUTORS

In the previous section; topographic, meteorological, and other factors important to determining the cause of the excesses were examined. In this section, sources which might have contributed to the excesses and the probable impact of each are discussed.

It is useful to examine the long-term relationship between SO_2 concentrations and wind directions to see if any particular condition is present during elevated levels. A convenient method of illustrating this relationship is a pollution rose. A pollution rose is a graphical display of the frequency that various combinations of wind direction and pollutant levels occur. Figure 2 contains 1979 climatological plots of these frequencies for each of the four stations (9, 11, 14, and 25) discussed in this report (all wind data are from the 10-meter level on the Widows Creek mountain tower). In each case, the SO_2 tends to come from one primary source--Widows Creek Steam Plant. While these pollution roses do indicate that Mead Corporation may also be a significant source for three stations (stations 9, 14, and 25), it is unlikely that Mead Corporation caused an excess of the secondary (3-hr) standard) because hourly SO_2 concentrations from that direction never exceeded 0.500 ppm (at least one hour in three would have to be over 0.500 for an excess to occur). Based on these pollution roses, it is conceivable that all three sources could have contributed to excesses of the primary (24-hour) standard given the proper wind direction.

POTENTIAL SOURCES

The following sources were identified as having the potential to cause or contribute to the excess SO_2 concentrations measured during 1979.

1. Widows Creek Steam Plant.
2. Mead Corporation.
3. Penn-Dixie Cement Corporation.
4. Domestic Home Heating.

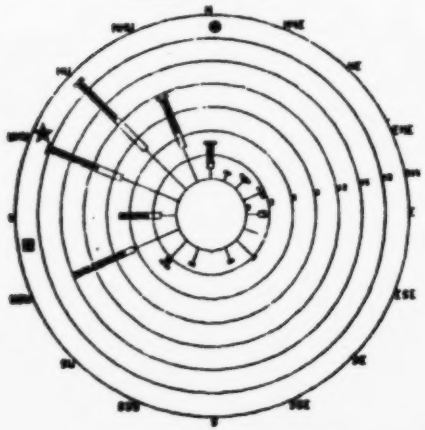
To determine the impact of each of these sources, estimates of ground-level SO_2 concentrations were made for each source (appendix D). Actual or probable SO_2 emissions and meteorological data were used whenever possible. When an input parameter was not known for certain, a conservative parameter value was selected so that an overestimate rather than an underestimate would result.

PROBABLE IMPACTS OF POTENTIAL SOURCES

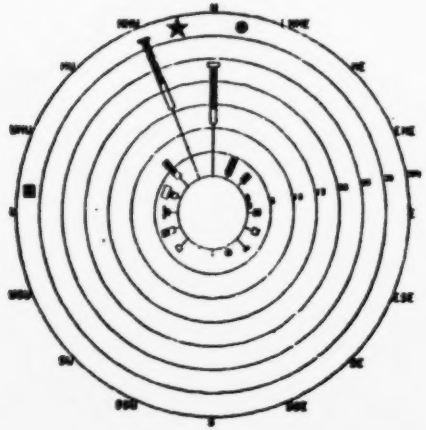
A number of situations have been devised which could explain the high SO_2 concentrations measured by the Widows Creek monitoring network. In this section, an assessment is made of each situation given the conditions which characterized the incidents.

Figure 2. POLLUTION ROSES, WIDOWS CREEK MONITORING STATIONS

Station 9

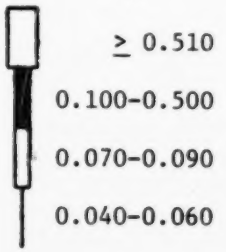


Station 11



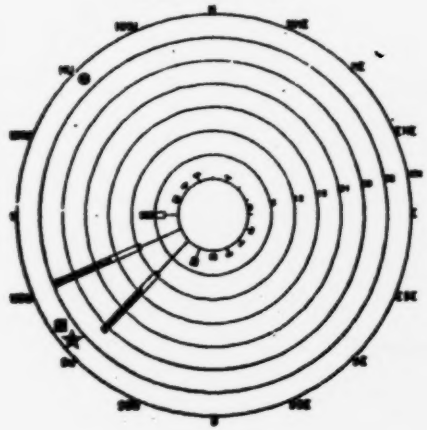
1-hour Average

SO2(PPM)

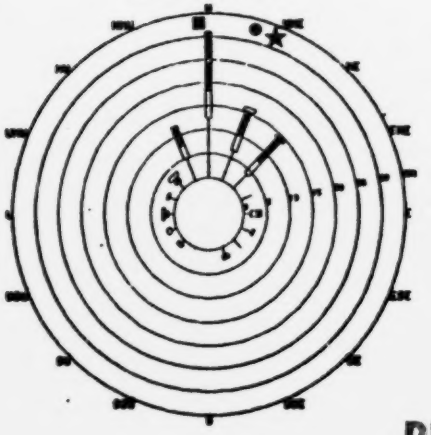


WIDOWS CREEK STEAM PLANT
10 METER WIND-MOUNTAIN TOWER
ALL WIND SPEEDS
JAN 1-DEC 31, 1979

Station 14



Station 25



Position of SO_2 Emission Sources in Relation to Monitor

- ■ Mead Corporation
- ● Penn-Dixie Cement Corporation
- ★ Widows Creek Steam Plant

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Widows Creek Steam Plant--TVA's Widows Creek Steam Plant is the largest SO_2 source in the vicinity. A final emission standard of 1.2 lbs/10^6 Btu has been established under the TVA Consent Decree. This compares with lowest actual plant average emissions of 2.1 lbs/10^6 Btu during excess SO_2 concentration periods. Therefore, although Widows Creek Steam Plant was in compliance with interim emission standards, it was not in compliance with final SO_2 emission standards at the time high SO_2 concentrations were measured, so excesses of ambient standards were not unexpected. Calculations indicate that units 7 and 8 combined were particularly capable of causing standards to be exceeded under some meteorological conditions given the interim SO_2 emission standards that applied during 1979.

Mead Corporation--Mead Corporation is a far smaller source than Widows Creek Steam Plant; however, it is close enough to monitoring stations 9, 11, and 25 to make significant contributions under proper conditions. Calculations indicate the Mead Corporation contributions would be less than 0.40 ppm in any case (appendix D), but enough SO_2 might be contributed to already existing SO_2 concentrations to ready excess levels. Such a combination will be short-lived since winds capable of causing Mead Corporation to impact one of the affected monitors will tend to be exclusive of other sources.

Penn-Dixie Cement Corporation--Penn-Dixie Cement Corporation is approximately the same size as Mead Corporation. However, Penn-Dixie is distant enough from the bulk of the monitoring network that it probably affected only the northern-most monitoring station (station 14 in this case). Calculations indicate that any contribution will be only slightly above background levels (<0.06 ppm). Therefore, Penn-Dixie Cement Corporation can probably be excluded as a significant contributor to the excess observed although contributions near background levels were possible.

Domestic Home Heating--On cold nights, coal-burning for home heating can emit significant quantities of SO_2, at least on a local scale. The capacity of a small hand-fired coal furnace is about 150 kilograms of coal per day. If the average sulfur content of the coal is assumed to be 3 percent, the emission rate per furnace would be about 0.1 g/sec. Under generally calm conditions (1 m/sec), this is sufficient to produce concentrations of nearly 0.50 ppm at 100 meters distance. However, the effects of local domestic heating will only be significant during cold nights (<20°C) and then only for short distances away (beyond 100 m, SO_2 concentrations drop off drastically). It is also possible for individual houses to combine either together and/or with major point sources to produce high SO_2 concentrations at a specific location.

Domestic home heating is probably not a major influence in the excesses measured at Widows Creek during 1979. Housing is sparce in the vicinity of all affected monitors (characteristic of a rural agricultural area), so no more than a few houses, only some of which might burn coal, are located close enough to affect a monitor. Also, only four of the excesses occurred when temperatures were cold enough (<20°C) for home heating to be expected.

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ANALYSIS OF INDIVIDUAL EXCESSES

In examining each of the individual incidents, a number of basic circumstances apply to every case.

1. Calculations (appendix D) indicate that only Widows Creek units 7-8 could have caused every excess observed.

2. The plume from the tallest stack at Widows Creek (305 m) generally has an effective plume height well above the escarpment so that its emissions were not a significant factor in any of the excesses.

3. With one exception (November 18, 1979), Mead Corporation and Penn-Dixie Cement Corporation effective plume heights remained below the escarpment so it is assumed, for calculation purposes, that these plumes were released at monitor level (it is expected that plumes would "follow" the terrain if wind directions force impact on the escarpment).

April 30, 1979

Calculations indicate that only Widows Creek units 7-8 could have caused the 3-hour excess of monitor 11. This is confirmed by estimated plume trajectories of other plumes; Mead Corporation and Penn-Dixie Cement Corporation plumes remained in the valley and were transported away from monitor 11 (based on 61-meter valley wind observations), while the unit 1-6 effective plume height was significantly above monitor 11 and probably did not impact the monitor. The unit 7-8 plume was emitted into a slightly stable layer and was transported toward the southeast at 0600 CDT, shifting to south-southeast by 0700 CDT, and then moving back toward the northeast by 1000 CDT (based on pibal wind observations). As the plume impacted on the edge of the escarpment during 0700-0800 CDT, surface winds (based on mountain 10-meter wind observations) transported SO_2 toward the southeast (toward monitor 11). As the plume shifted back along the escarpment toward the northeast, surface winds transported SO_2 toward the northeast. This resulted in a shifting of highest SO_2 concentrations from station 11 at 0700-0800 CDT to station 10 at 0900-1000 CDT with significant SO_2 concentrations being observed at all stations between 11 and 10 (stations 6, 3, and 9) as the plume shifted past these stations.

July 1, 1979

Calculations indicate that only Widows Creek units 7-8 could have caused the 3-hour excess of monitor 14. Estimated plume trajectories (based on valley 61-meter wind observations) indicate that the Penn-Dixie Cement Corporation plume was not transported towards monitor 14 during 0400-1000 CDT. The Mead Corporation plume was not transported towards monitor 14 during 0500-0700 CDT, but may have contributed to low concentrations (<.10 ppm) at station 8 during 0400-0500 CDT and 0700-0900 CDT. The Mead Corporation plume may have also contributed to the low concentration (.06 ppm) measured at station 14 during 0900-1000 CDT, after the highest concentrations occurred. The Widows Creek unit 1-6 plume was transported in the same direction as the unit 7-8 plume but with an effective plume height significantly above surface monitor 14, so the unit 1-6 plume probably did not contribute to the excess. The unit 7-8 plume was transported to the east-northeast (towards monitor 14)

throughout the period 0400-1000 CDT, with estimated impact within 2 kilometers south of monitor 14 (between monitors 8 and 14) during 0400-0800 CDT. Surface winds (based on mountain 10-meter wind observations) transported SO_2 toward the northeast from the impact locations (towards monitor 14). The unit 7-8 plume shifted south along the escarpment to an impact location south of monitor 8 during 0800-1000 CDT, after the highest concentrations had been recorded at station 14. High SO_2 concentrations shifted from station 14, at 0800-0900 CDT, to station 8, at 0900-1000 CDT; as the unit 7-8 plume passed station 8.

July 26-27, 1979

Calculations indicate that while only Widows Creek units 7-8 could solely cause the 24-hour excess of station 14, Penn-Dixie Cement Corporation and Mead Corporation could have contributed significant concentrations. Although the excess occurred during the 24-hour period ending at 1700 CDT on July 27, 1979; the critical period of elevated SO_2 concentrations occurred from 0100-1700 CDT on July 27, 1979. During that period, the Penn-Dixie Cement Corporation plume was transported towards the north-northeast through northwest (away from station 14). The Mead Corporation plume was transported towards the northeast (in the general direction of stations 8 and 14) during 0100-0200 CDT and 0300-0800 CDT. Outside these time periods, the Mead Corporation plume was transported to the north-northeast, passing to the west of station 14. Both Widows Creek plumes were transported to the northeast (generally passing between stations 8 and 14) throughout the 0100-1700 CDT period. The unit 1-6 plume had an effective plume height well above the surface and did not significantly contribute to the elevated concentrations. The unit 7-8 plume impacted between stations 8 and 14, with surface winds (based on 10-meter mountain wind direction) transporting the SO_2 towards monitor 14. The 24-hour excess primarily resulted due to almost constant impact of the Widows Creek unit 7-8 plume, and associated elevated concentrations, during the 0100-1700 CDT period.

July 30, 1979

Calculations indicate that only Widows Creek units 7-8 could have caused the 3-hour excess at monitor 11. Estimated plume trajectories for Mead Corporation and Penn-Dixie Cement Corporation indicate that these plumes remained in the valley and were transported downvalley, with no significant impact on monitor 11. The Widows Creek unit 1-6 plume was transported toward the escarpment but was well above the surface and did not have a significant contribution to the excess. The Widows Creek unit 7-8 plume was transported towards the southeast during 0200-0700 CDT, impacting the escarpment near monitor 11. Surface winds on the escarpment (based on 10-meter mountain data), carried SO_2 northeast from the point of impact resulting in concentrations slightly above background at other monitors in the vicinity. Significant concentrations ceased as inversion breakup rapidly diffused the previously tight fanning plume.

August 15, 1979

Calculations indicate that only Widows Creek units 7-8 could have caused the 3-hour excess observed at station 25, although calculations also

indicate that Mead Corporation could have caused the excess but not some of the component hourly concentrations (greater than 0.60 ppm). Estimated plume trajectories indicate that Penn-Dixie Cement Corporation plume was transported downvalley towards the southwest and was not a factor in the excess. Mead Corporation plume was also transported downvalley towards the southwest during 0100-0500 CDT, but was transported almost due south after 0500 CDT. Although the shift in plume direction brought the Mead Corporation plume closer to station 25, the plume still remained to the west of the monitor, and probably did not contribute more than the low SO_2 concentrations located in the fringe area of the plume. Both Widows Creek plumes were transported almost due south towards monitor 25 during the period of highest SO_2 concentrations (0300-0700 CDT). The unit 1-6 plume was high above the surface and probably did not contribute significant SO_2 to the excess, while the unit 7-8 plume impacted the escarpment near monitor 25. SO_2 concentrations gradually increased as surface winds (based on mountain 10-meter data) were too light in speed (less than 1 m/sec) to adequately ventilate the area. Concentrations decreased as the surface wind increased slightly in speed and the deepening mixing layer provided a larger volume for plume diffusion.

November 18, 1979

Calculations indicate that only Widows Creek units 7-8 could have caused the 3-hour excess at station 9. Plume trajectories indicate that plumes from both Mead Corporation and Penn-Dixie Cement Corporation, were transported downvalley until 1000 CST and then upvalley after 1000 CST, but were never transported near monitor 9. Both Widows Creek plumes were transported in the same directions throughout the excess period, however, only the unit 7-8 plume was close enough to the surface to contribute significant SO_2 concentrations. During 0800-0900 CST, the unit 7-8 plume was impacting on the side of the escarpment just north of monitor 11. Surface winds transported the SO_2 towards station 11 so it recorded the highest SO_2 concentrations during the period (0.33 ppm). During 0900-1000 CST, the plume shifted northeast along the escarpment as indicated by high concentrations at station 9 (0.63 ppm), but surface winds also transported significant SO_2 to the south and southwest as indicated by elevated SO_2 readings at stations 3 and 6 (0.51 ppm and 0.53 ppm respectively). During 1000-110 CST, the unit 7-8 plume continued to shift to the northeast as indicated by increasing SO_2 concentrations at station 10 (0.09 ppm) and decreasing concentrations at stations 3 and 6 (0.29 ppm and 0.20 ppm respectively), although the primary impact was near station 9 (1.04 ppm). By 1200 CDT, the plume shifted away from monitor 9 (0.02 ppm) and was impacting closer to monitor 10 (0.70 ppm). The 3-hour excess occurred as the plume passed station 9, which recorded high enough concentrations to cause an excess.

December 26-27, 1979

Calculations indicate that both Widows Creek unit 7-8 and Domestic Home Heating (within 100 meters) could have caused both a 3-hour and 24-hour excess at station 25. The 24-hour excess resulted primarily due to the 3-hour excess combined with other SO_2 measurements outside the excess period. Therefore, an explanation of causes of the 3-hour excess will also explain the

24-hour excess. Estimated plume trajectories indicate that plumes from both Mead Corporation and Penn-Dixie Cement Corporation were transported towards the southwest and did not influence station 25. Both Widows Creek plumes were transported to the south during 0000-0300 CDT when the 3-hour excess occurred. The unit 1-6 plume was well above the surface and did not contribute significantly to the SO_2 concentrations. The unit 7-8 plume impacted the escarpment northeast of station 25, but surface winds (based on 10-meter mountain measurements) transported SO_2 towards station 25. A single house was located approximately 50 meters to the northeast of station 25. Under the existing conditions (air temperature $<0^{\circ}C$), coal-burning at this house might have been a significant influence. However, SO_2 concentrations high enough to cause an excess would have been confined in a very narrow band (only 2 meters across). The observed changes in surface wind directon (30°) were many times greater than the 5° wind direction shift necessary to cause such a narrow band of high SO_2 concentration to miss the monitor completely. Therefore, while the nearby house could have contributed some of the SO_2 concentrations observed, the Widows Creek unit 7-8 plume was still the predominant probable cause of the 3-hour (and subsequent 24-hour) excess.

Summary

In each of these excesses, the Widows Creek Steam Plant units 7-8 plume was probably responsible for the high ground-level SO_2 concentrations. Since unit 8 emissions were reduced by the SO_2 scrubber, unit 7 emissions comprised the bulk (approximately 80-85%) of the SO_2 in the plume. At the time of these excesses, unit 7 was in compliance with the interim SO_2 emission standard (6.5 $lb/10^6$ Btu), but not in compliance with the final SO_2 emission standard (1.2 $lb/10^6$ Btu). Had unit 7 been in compliance with the final emission standard, SO_2 emissions from units 7-8 would have been reduced by 58-65 percent. This would have been sufficient to reduce all excess measurements to nonexcess levels.

Unit 7 SO_2 emissions can also be considered as a significant factor in the increased the number of excesses in 1979 (8 excesses in 1979 compared with 1 excess in 1978). The 318 days unit 7 operated during 1979 is almost double the 160 days unit 7 operated during 1978. This factor alone may account for a significant portion of the increase in the number of excesses.

CONCLUSIONS

1. Widows Creek Steam Plant was probably the primary contributor to all SO_2 excesses measured during 1979 by the Widows Creek air monitoring network.

2. SO_2 emissions from Widows Creek unit 7 (mixed with unit 8 SO_2 emissions) were probably responsible for the excesses. The significant increase in unit 7 operating time during 1979 (318 days in 1979 versus 160 days in 1978) was a major factor in the increased number of excesses in 1979 (8 excesses in 1979 versus 1 excess in 1978).

3. Mead Corporation, Penn-Dixie Cement Corporation, and Domestic Home Heating may have contributed SO_2 concentrations above background level in some cases, but were neither large enough or persistent enough to be the primary contributors in any case.

4. Widows Creek Steam Plant was operating in compliance with interim SO_2 emission standards during 1979. The interim standards permitted SO_2 emission levels above those determined appropriate to prevent excesses of the NAAQS. Until the plant achieves compliance with the final SO_2 emission standards stated in the TVA Consent Decree (September, 1981), occasional ambient concentrations in excess of NAAQS can be expected.

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APPENDIXES

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Appendix A

Ambient SO_2 Concentration Data

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Table A-1

WIDOWS CREEK STEAM PLANT
AMBIENT SO_2 MONITORING NETWORK - MONITOR LOCATIONS

Monitor No.	Direction From Plant (°)	Distance From Plant (km)	Elevation above Plant Grade (m)
3	135	4.0	251
6	158	3.5	267
8	69	8.9	284
9	118	3.5	266
10	102	3.2	266
11	166	3.2	287
14	54	10.6	287
15	348	8.7	272
17	272	30.4	353
18	233	7.4	23
20	316	10.5	254
23	28	4.3	17
24	139	1.6	4
25	192	7.3	261

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Table A-2

WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

April 30, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00
0200	.00	.00	.02	.01	.00	.00	.04	.03	.02	.01	.02	.00	.01	.00
0300	.00	.00	.02	.01	.00	.00	.03	.03	.01	.01	.03	.00	.01	.00
0400	.01	.00	.03	.01	.02	.01	.03	.03	.03	.01	.17	.02	.03	.01
0500	.00	.00	.05	.02	.02	.01	.03	.02	.01	.01	.17	.03	.03	.02
0600	.01	.00	.02	.02	.02	.01	.02	.01	.01	.01	1.54	.10	.02	.01
0700	.11	.00	.72	.01	.03	.02	.60	.01	.02	.01	1.42	.51	.03	.02
0800	.46	.02	.70	.21	.02	.01	1.28	.08	2.28	.01	1.10	.88	.03	.02
0900	NF	.20	NF	.18	NF	.01	NF	.48	NF	.59	NF	.27	NF	.02
1000	.22	.04	.02	.00	.01	.01	.24	.07	.86	.38	.01	.00	.02	.01
1100	.20	.04	.39	.04	.02	.01	.07	.01	.04	.01	.02	.00	.01	.01
1200	.03	.00	.62	.31	.01	.01	.02	.01	.00	.00	.26	.06	.01	.00
1300	.34	.08	.47	.16	.00	.00	.05	.01	.03	.00	.35	.12	.01	.00
1400	.01	.01	.18	.02	.00	.00	.02	.01	.00	.00	.22	.10	.00	.00
Maximum 3-hr. Avg.		.09		.17		.01		.21		.33		.55		.02

NF = Not found (by computer)

BEST DOCUMENT AVAILABLE

Table A-2
(Continued)

April 30, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0100	0.03	0.02	0.01	0.00	0.00	0.00	0.01	0.00	0.00	LR	0.00	0.00	0.03	0.01
0200	.01	.01	.00	.00	.00	.00	.03	.02	.00	LR	.02	.01	.03	.01
0300	.03	.01	.00	.00	.00	.00	.04	.02	.00	LR	.02	.01	.01	.00
0400	.02	.01	.01	.00	.00	.00	.02	.01	.00	LR	.01	.01	.07	.00
0500	.08	.04	.01	.01	.00	.00	.03	.02	.00	LR	.02	.01	.07	.02
0600	.07	.04	.01	.01	.00	.00	.03	.02	.00	LR	.01	.01	.14	.03
0700	.03	.04	.00	.00	.01	.00	.02	.01	.00	LR	.02	.01	.72	.03
0800	.02	.02	.01	.00	.11	.00	.01	.01	.00	LR	.01	.01	.64	.25
0900	NF	.01	NF	.00	NF	.07	NF	.01	NF	LR	NF	.01	NF	.18
1000	.01	.00	.01	.01	.11	.07	.01	.00	.00	LR	.02	.01	.05	.01
1100	.01	.01	.01	.01	.06	.05	.01	.00	.00	LR	.05	.03	.01	.00
1200	.01	.01	.01	.01	NE	NE	.01	.00	.00	LR	.25	.10	.00	.00
1300	.02	.01	.01	.01	NE	NE	.00	.00	.00	LR	.31	.12	.03	.01
1400	.01	.01	.01	.01	NE	NE	.01	.00	.00	LR	.06	.02	.05	.03
Maximum 3-hr. Avg.		.04		.01		.06		.02		.00		.08		.15

LR = Lost record
NE = Not enough readings to determine value
NF = Not found (by computer)

BEST DOCUMENT AVAILABLE

Table A-3

WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

July 1, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0100	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00
0200	.00	.00	.00	.00	.03	.02	.00	.00	.01	.01	.00	.00	.02	.01
0300	.00	.00	.00	.00	.12	.04	.00	.00	.01	.00	.00	.00	.05	.03
0400	.00	.00	.00	.00	.28	.10	.00	.00	.01	.00	.00	.00	.11	.07
0500	.00	.00	.00	.00	.17	.05	.00	.00	.01	.01	.01	.00	.43	.10
0600	.00	.00	.00	.00	.00	.00	.00	.00	.02	.01	.00	.00	1.27	.20
0700	.00	.00	.00	.00	.02	.00	.00	.00	.01	.01	.00	.00	1.17	.46
0800	.00	.00	.00	.00	.17	.03	.00	.00	.02	.01	.00	.00	1.65	.83
0900	.01	.00	.02	.01	.19	.09	.01	.01	.02	.01	.01	.01	.74	.33
1000	.00	.00	.01	.00	.24	.15	.01	.00	.02	.01	.00	.00	.21	.06
1100	.00	.00	.00	.00	.20	.09	.00	.00	.01	.01	.00	.00	.03	.01
1200	.00	.00	.00	.00	.15	.08	.01	.01	.01	.01	.00	.00	.10	.03
1300	.00	.00	.00	.00	.00	.00	.02	.01	.15	.02	.00	.00	.00	.00
1400	.00	.00	.00	.00	.00	.00	.01	.01	.10	.01	.00	.10	.00	.00
Maximum 3-hr. Avg.		.00		.00		.11		.01		.01		.01		.54

BEST DOCUMENT AVAILABLE

Table A-3
(Continued)

July 1, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0100	0.03	0.02	0.01	0.01	0.00	0.00	NE	NE	0.01	0.00	0.00	0.00	0.00	0.00
0200	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0300	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0400	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0500	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
0600	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0700	.00	.00	.01	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00
0800	.00	.00	.02	.02	.00	.00	.00	.00	.00	.01	.00	.00	.01	.00
0900	.00	.00	.02	.01	.00	.00	.00	.00	.00	.01	.00	.00	.01	.01
1000	.00	.00	.01	.01	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00
1100	.00	.00	.01	.01	.00	.00	.00	.00	.22	.03	.00	.00	.00	.00
1200	.00	.00	.01	.01	.00	.00	.00	.00	.19	.03	.00	.00	.00	.00
1300	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1400	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Maximum 3-hr. Avg.		.01		.01		.00		.00		.02		.00		.00

NE = Not enough readings to determine value

BEST DOCUMENT AVAILABLE

Table A-4

WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

July 26, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
1600	0.00	0.00	LR	LR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
1700	.00	.00	LR	LR	.06	.01	.00	.00	.00	.00	.00	.00	.10	.03
1800	.00	.00	LR	LR	.01	.01	.00	.00	.00	.00	.00	.00	.13	.05
1900	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2100	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2200	.00	.00	LR	LR	.01	.00	.00	.00	.02	.01	.00	.00	.01	.00
2300	.00	.00	LR	LR	.01	.00	.00	.00	.01	.00	.00	.00	.01	.00
2400	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
July 27, 1979														
0100	0.00	0.00	LR	LR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0200	.00	.00	LR	LR	.00	.00	.04	.00	.00	.00	.00	.00	.53	.30
0300	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.56	.15
0400	.00	.00	LR	LR	.00	.00	.00	.00	.01	.00	.01	.01	.65	.34
0500	.00	.00	LR	LR	.04	.01	.00	.00	.01	.00	.01	.01	.75	.37
0600	.00	.00	LR	LR	.01	.01	.00	.00	.00	.00	.01	.01	.87	.42
0700	.00	.00	LR	LR	.01	.00	.00	.00	.01	.00	.01	.00	.30	.16
0800	.00	.00	LR	LR	.00	.00	.00	.00	.02	.01	.00	.00	.67	.30
0900	.00	.00	LR	LR	.04	.01	.00	.00	.02	.01	.00	.00	.64	.29
1000	.00	.00	LR	LR	.02	.01	.00	.00	.01	.00	.00	.00	.45	.24
1100	.00	.00	LR	LR	.02	.01	.00	.00	.00	.00	.00	.00	.38	.13
1200	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.15	.02
1300	.00	.00	LR	LR	.08	.02	.00	.01	.00	.00	.00	.00	.31	.11
1400	.00	.00	LR	LR	.02	.00	.00	.02	.00	.00	.01	.00	.58	.29
1500	.00	.00	LR	LR	.04	.01	.00	.00	.00	.00	.02	.01	.29	.12

LR = Lost record

BEST DOCUMENT AVAILABLE

Table A-4 (Continued)

WIDOWS CREEK STEAM PLANT

OBSERVED SO_2 CONCENTRATIONS

July 26, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
1600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.01	0.00
1700	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1800	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.00	.00	.00	.00
1900	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
2000	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.01	.00	.00
2100	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
2200	.01	.00	.00	.00	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00
2300	.01	.00	.00	.00	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00
2400	.01	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
July 27, 1979														
0100	0.01	0.01	0.00	.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0200	.00	.00	LR	LR	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00
0300	.01	.01	LR	LR	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00
0400	.02	.01	LR	LR	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00
0500	.02	.01	LR	LR	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00
0600	.00	.00	LR	LR	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00
0700	.01	.01	LR	LR	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00
0800	.02	.01	LR	LR	.00	.00	LR	LR	.01	.00	.00	.00	.00	.00
0900	.02	.01	LR	LR	.00	.00	LR	LR	.01	.00	.00	.00	.00	.00
1000	.02	.01	LR	LR	.01	.00	LR	LR	.01	.01	.01	.00	.01	.00
1100	.01	.01	LR	LR	.01	.00	LR	LR	.01	.01	.01	.00	.01	.00
1200	.01	.01	LR	LR	.00	.00	LR	LR	.01	.00	.01	.00	.00	.00
1300	.00	.00	LR	LR	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00
1400	.01	.01	LR	LR	.00	.00	LR	LR	.02	.01	.00	.00	.00	.00
1500	.01	.01	LR	LR	.00	.00	LR	LR	.02	.01	.01	.00	.00	.00

LR = Lost record

BEST DOCUMENT AVAILABLE

Table A-4
(Continued)

July 27, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
1600	.00	.00	LR	LR	.05	.01	.00	.01	.00	.00	.01	.01	.24	.09
1700	.00	.00	LR	LR	.09	.01	.00	.04	.00	.00	.01	.01	.36	.16
1800	.00	.00	LR	LR	.01	.00	.00	.00	.00	.00	.01	.01	.17	.04
1900	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2100	.00	.00	LR	LR	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
2200	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2300	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2400	.00	.00	LR	LR	.02	.01	.00	.00	.00	.00	.01	.01	.02	.02
July 28, 1979														
0100	.00	.00	LR	LR	.02	.02	.00	.00	.02	.01	.02	.01	.02	.02
Maximum 3-hr. Avg.		.00		LR		.01		.02		.01		.01		.38
24-hr. Avg.		.00		LR		.01		.00		.00		.00		.15

LR = Lost record

BEST DOCUMENT AVAILABLE

Table A-4 (Continued)

July 27, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
1600	0.01	0.00	LR	LR	0.00	0.00	LR	LR	0.00	0.00	0.00	0.00	0.00	0.00
1700	.01	.00	LR	LR	.00	.00	LR	LR	.20	.03	.00	.00	.00	.00
1800	.01	.01	LR	LR	.00	.00	LR	LR	.04	.01	.00	.00	.00	.00
1900	.01	.01	LR	LR	.00	.00	LR	LR	.01	.01	.00	.00	.00	.00
2000	.01	.01	LR	LR	.00	.00	LR	LR	.02	.01	.00	.00	.00	.00
2100	.02	.01	LR	LR	.00	.00	LR	LR	.01	.01	.00	.00	.00	.00
2200	.02	.01	LR	LR	.00	.00	LR	LR	.01	.01	.00	.00	.00	.00
2300	.02	.01	LR	LR	.00	.00	LR	LR	.01	.01	.00	.00	.00	.00
2400	.02	.02	LR	LR	.00	.00	LR	LR	.01	.00	.00	.00	.01	.01
July 28, 1979														
0100	.02	.02	LR	LR	.00	.00	LR	LR	.01	.01	.01	.00	.02	.01
Maximum 3-hr. Avg.		.02		LR		.00		LR		.02		.00		.01
24-hr. Avg.		.01		LR		.00		LR		.01		.00		.00

LR = Lost record

BEST DOCUMENT AVAILABLE

Table A-5

WIDOWS CREEK STEAM PLANT

OBSERVED SO_2 CONCENTRATIONS

July 29-30, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
2200	0.00	0.00	LR	LR	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00
2300	.00	.00	LR	LR	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00
2400	.00	.00	LR	LR	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00
0100	.00	.00	LR	LR	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00
0200	.00	.00	LR	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0300	.00	.00	LR	LR	.02	.01	.02	.01	.02	.00	.01	.01	.00	.00
0400	.01	.00	LR	LR	.01	.01	.05	.03	.20	.04	.85	.07	.00	.00
0500	.00	.00	LR	LR	.01	.00	.05	.03	.03	.01	4.81	1.31	.00	.00
0600	.47	.04	LR	LR	.01	.01	.02	.02	.00	.00	4.99*	1.33	.00	.00
0700	.08	.03	LR	LR	.01	.00	.26	.09	.02	.00	.39	.18	.00	.00
0800	.23	.09	LR	LR	.14	.04	.44	.23	.39	.13	.23	.10	.00	.00
0900	.05	.01	LR	LR	.13	.08	.13	.06	.43	.14	.05	.02	.05	.02
1000	.01	.00	LR	LR	.13	.06	.12	.04	.12	.03	.01	.01	.03	.01
1100	.00	.00	LR	LR	.03	.02	.02	.01	.01	.00	.01	.01	.01	.01
1200	.01	.00	LR	LR	.18	.07	.02	.01	.00	.00	.01	.01	.02	.01
1300	.00	.00	LR	LR	.23	.12	.02	.02	.00	.00	.01	.01	.19	.07
Max 3-hr Average		0.05		0.00		0.06		0.13		0.03		0.94		0.03

*Monitor off scale (0-5 ppm) range

LR = Lost record

BEST DOCUMENT AVAILABLE

Table A-5 (Continued)

July 29-30, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
2200	0.00	0.00	LR	LR	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.04	0.01
2300	.00	.00	LR	LR	.02	.01	.00	.00	.01	.01	.01	.00	.02	.00
2400	.02	.01	LR	LR	.01	.01	.00	.00	.01	.00	.00	.00	.00	.00
0100	.02	.01	LR	LR	.01	.01	LR	LR	.01	.00	NE	NE	.00	.00
0200	.00	.00	LR	LR	.00	.00	LR	LR	.01	.01	.00	.00	.01	.01
0300	.00	.00	LR	LR	.00	.00	LR	LR	.01	.01	IM	IM	.02	.01
0400	.03	.01	LR	LR	.00	.00	LR	LR	.01	.00	IM	IM	.02	.01
0500	.04	.01	LR	LR	.00	.00	LR	LR	.00	.00	IM	IM	.01	.01
0600	.02	.01	LR	LR	.00	.00	LR	LR	.00	.00	NE	NE	.02	.01
0700	.00	.00	LR	LR	.00	.00	LR	LR	.01	.00	NE	NE	.01	.00
0800	.00	.00	LR	LR	.00	.00	LR	LR	.01	.01	IM	IM	.01	.01
0900	.00	.00	LR	LR	.00	.00	LR	LR	.01	.01	.01	.00	.01	.01
1000	.00	.00	LR	LR	.00	.00	LR	LR	.02	.01	.02	.01	.01	.00
1100	.00	.00	LR	LR	.00	.00	LR	LR	.04	.02	.02	.01	.00	.00
1200	.00	.00	LR	LR	.00	.00	LR	LR	.02	.01	.00	.00	.00	.00
1300	.00	.00	LR	LR	.00	.00	LR	LR	.05	.01	.00	.00	.00	.00
Max 3-hr Average		0.01		0.00		0.01		0.00		0.01		0.01		0.01

IM = Instrument maintenance
LR = Lost record
NE = Not enough readings to determine value

BEST DOCUMENT AVAILABLE

Table A-6

WIDOWS CREEK STEAM PLANT

OBSERVED SO_2 CONCENTRATIONS

August 14-15, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
2200	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.07	0.01	0.01
2300	.00	.00	.02	.00	.00	.00	.00	.00	.01	.01	.05	.02	.02	.01
2400	.00	.00	.02	.00	.00	.00	.00	.00	.01	.01	.03	.01	.02	.01
0100	.00	.00	.02	.01	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00
0200	.00	.00	.20	.04	.01	.00	.00	.00	.00	.00	.05	.01	.00	.00
0300	.00	.00	.01	.01	.00	.00	.00	.00	.01	.00	.24	.09	.00	.00
0400	.00	.00	.01	.01	.00	.00	.00	.00	.01	.00	3.02	.23	.00	.00
0500	.00	.00	.01	.01	.00	.00	.00	.00	.02	.00	.04	.01	.00	.00
0600	.00	.00	.12	.04	.00	.00	.00	.00	.00	.00	.36	.09	.00	.00
0700	.00	.00	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0800	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	3.26	.15	.00	.00
0900	.00	.00	.01	.01	.00	.00	.00	.00	.01	.00	3.90	.50	.00	.00
1000	.01	.00	.02	.01	.00	.00	.00	.00	.01	.00	2.48	.53	.01	.00
1100	.01	.01	.02	.01	.00	.00	.00	.00	.01	.01	.02	.01	.00	.00
1200	.01	.00	.04	.01	.00	.00	.00	.00	.01	.01	.39	.12	.00	.00
Max 3-hr Average		0.00		0.02		0.00		0.00		0.01		0.39		0.01

BEST DOCUMENT AVAILABLE

Table A-6 (Continued)

August 14-15, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
2200	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.01
2300	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.02
2400	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.01	.00	.05	.02
0100	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.02
0200	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.02	.01
0300	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.31	.05
0400	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.99	.27
0500	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	1.90	.94
0600	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.69	.54
0700	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.25	.10
0800	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.36	.10
0900	.00	.00	.00	.00	.06	.04	.00	.00	.00	.00	.00	.00	.21	.11
1000	.01	.00	.00	.00	.06	.03	.00	.00	.00	.00	.01	.01	.26	.03
1100	.00	.00	IM	IM	.02	.01	.00	.00	.00	.00	.02	.01	.14	.06
1200	.00	.00	IM	IM	.01	.01	.00	.00	.01	.00	.22	.05	.14	.07
Max 3-hr Average		0.00		0.01		0.03		0.00		0.00		0.02		0.58

IM = Instrument maintenance

BEST DOCUMENT AVAILABLE

Table A-7

WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

November 18, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.04	0.01
0400	.00	.00	.00	.00	.11	.04	.00	.00	.00	.00	.00	.00	.00	.00
0500	IM	.00	.00	.00	.02	.01	.00	.00	.02	.01	.02	.01	.01	.00
0600	IM	.00	.00	.00	.01	.00	.01	.01	.01	.01	.04	.01	.00	.00
0700	IM	.00	.01	.01	.00	.00	.01	.01	.01	.01	.10	.02	.00	.00
0800	IM	.01	.10	.02	.00	.00	.20	.02	.08	.02	.14	.02	.00	.00
0900	NE	.08	.34	.17	.00	.00	1.03	.17	.15	.06	.56	.33	.00	.00
1000	1.53	.51	1.10	.53	.00	.00	1.80	.63	.01	.00	.49	.28	.00	.00
1100	1.06	.29	.25	.20	.00	.00	3.13	1.04	.68	.09	.24	.07	.00	.00
1200	.02	.01	.02	.01	.00	.00	.54	.02	.70	.12	.05	.02	.00	.00
1300	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.01	.01	.00	.00
1400	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1500	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1600	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1700	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Max 3-hr average		0.29		0.30		0.02		0.61		0.07		0.23		0.00

LR = Lost record

BEST DOCUMENT AVAILABLE

Table A-7
(Continued)

November 18, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
0400	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.01	.01
0500	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
0600	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
0700	.02	.01	.01	.00	.01	.00	.00	.00	.00	.00	.00	.00	.01	.01
0800	.01	.01	.01	.00	.01	.00	.01	.00	.00	.00	.00	.00	.36	.06
0900	.00	.00	.01	.01	.01	.01	.00	.00	.00	.00	.00	.00	.33	.16
1000	.00	.00	.01	.01	.03	.01	.00	.00	.02	.01	.01	.00	.07	.04
1100	.00	.00	.01	.01	.07	.05	.20	.05	.01	.00	.24	.09	.06	.01
1200	.00	.00	NF	.01	.07	.05	.35	.15	.15	.00	.14	.08	.02	.01
1300	.00	.00	.00	.00	.03	.01	.04	.02	.11	.02	.04	.01	.02	.01
1400	.00	.00	.00	.00	.02	.01	.01	.01	.05	.01	.01	.00	.00	.00
1500	.00	.00	.00	.00	.02	.01	.01	.01	.02	.01	.01	.01	.00	.00
1600	.00	.00	.00	.00	.02	.01	.01	.01	.02	.00	.01	.01	.00	.00
1700	.00	.00	.00	.00	.02	.01	.01	.00	.00	.00	IM	.00	.00	.00
Max 3-hr average		0.01		0.01		0.04		0.07		0.03		0.06		0.09

IM = Instrument maintenance
LR = Lost record
NE = Not enough readings to determine value

BEST DOCUMENT AVAILABLE

Table A-8a
WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

December 26, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
1000	0.00	LR	0.02	0.00	IM	IM	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
1100	.00	LR	.08	.02	IM	IM	.00	.00	.00	.00	.12	.03	.00	.00
1200	.00	LR	.11	.03	.00	.00	.00	.00	.00	.00	.21	.05	.00	.00
1300	.00	LR	.62	.10	.00	.00	.00	.00	.00	.00	.12	.05	.00	.00
1400	.00	LR	.51	.20	.00	.00	.04	.01	.00	.00	.43	.14	.00	.00
1500	.02	LR	.27	.10	.00	.00	.18	.07	.20	.05	.04	.01	.00	.00
1600	.00	LR	.00	.00	.01	.00	.42	.08	.44	.08	.02	.00	.00	.00
1700	.00	LR	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.02	.01
1800	.00	LR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1900	.00	LR	.10	.04	.00	.00	.00	.00	.00	.00	.03	.01	.00	.00
2000	.00	LR	.02	.01	.01	.00	.00	.00	.00	.00	.02	.01	.00	.00
2100	.00	LR	.01	.00	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00
2200	.00	LR	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	IM	IM
2300	.00	LR	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.00	.00
2400	.00	LR	.01	.00	.00	.00	.00	.00	.00	.00	.05	.01	.00	.00

IM = Instrument maintenance
LR = Lost record

BEST DOCUMENT AVAILABLE

Table A-8a
(Continued)
WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

December 26, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
1000	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01
1100	.00	.00	.00	.00	.01	.00	.00	.00	.01	.01	IM	IM	.01	.00
1200	.00	.00	.00	.00	.01	.00	.00	.00	.01	.00	.18	.01	.00	.00
1300	.00	.00	.01	.00	.00	.00	.00	.00	.01	.00	.10	.05	.02	.00
1400	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.34	.13	.00	.00
1500	.00	.00	.00	.00	.01	.00	.00	.00	NE	NE	.38	.08	.00	.00
1600	.00	.00	.00	.00	.01	.00	.00	.00	.05	.02	.00	.00	.00	.00
1700	.00	.00	.00	.00	.01	.01	.00	.00	.01	.00	IM	IM	.01	.00
1800	.00	.00	.00	.00	.01	.00	.00	.00	.01	.00	.00	.00	.01	.00
1900	.00	.00	.00	.00	.01	.01	.00	.00	.00	.00	.01	.00	.00	.00
2000	.00	.00	.00	.00	.01	.01	.00	.00	.00	.00	.01	.00	.00	.00
2100	.00	.00	.00	.00	.05	.01	.00	.00	.01	.00	IM	IM	.04	.01
2200	.00	.00	.00	.00	.02	.01	.00	.00	.01	.01	.00	.00	.10	.02
2300	.00	.00	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.08	.02
2400	.00	.00	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.30	.22

IM = Instrument Maintenance
NE = Not enough readings to determine value

BEST DOCUMENT AVAILABLE

Table A-8b
WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

December 27-28, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 3		Station 6		Station 8		Station 9		Station 10		Station 11		Station 14	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0100	0.00	LR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
0200	.07	LR	.00	.00	.00	.00	.00	.00	.01	.00	.01	.00	.02	.01
0300	.00	LR	.00	.00	.00	.00	.00	.00	.01	.00	.01	.00	.02	.01
0400	.00	LR	.02	.01	.02	.01	.00	.00	.02	.01	.02	.01	.03	.02
0500	.00	LR	.02	.02	.03	.02	.01	.01	.02	.02	.02	.02	.04	.03
0600	.00	LR	.02	.02	.02	.01	.01	.01	.02	.02	.02	.02	.03	.03
0700	.00	LR	.02	.01	.02	.01	.02	.01	.02	.02	.02	.02	.02	.02
0800	.00	LR	.02	.01	.02	.01	.01	.01	.02	.02	.02	.02	.02	.02
0900	.00	LR	.02	.01	.02	.01	.02	.01	.02	.02	.02	.02	.02	.02
1000	.00	LR	.02	.02	.01	.01	.02	.01	.02	.02	.02	.02	.02	.01
1100	.00	LR	.02	.01	.00	.00	.02	.01	.02	.01	.02	.01	.02	.01
1200	.00	LR	.01	.01	.00	.00	.01	.00	.01	.01	.01	.01	.00	.00
1300	.00	LR	.02	.01	.00	.00	.00	.00	.01	.01	1.30	.32	.01	.00
1400	.00	LR	.48	.05	.00	.00	.02	.01	.02	.01	.20	.06	.00	.00
1500	.00	LR	.06	.04	.00	.00	.22	.04	.04	.02	.06	.03	.00	.00
1600	.00	LR	.02	.01	.00	.00	.02	.00	.01	.01	.04	.01	.01	.01
1700	.00	LR	.01	.01	.00	.00	.00	.00	.01	.01	.00	.00	.01	.01
1800	.00	LR	.01	.01	.00	.00	.01	.01	.02	.01	.00	.00	.01	.01
1900	.00	LR	.01	.01	.00	.00	.00	.00	.01	.01	.01	.01	.01	.00
2000	.00	LR	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2100	.00	LR	.00	.00	.00	.00	.00	.00	.01	.00	.01	.00	.01	.00
2200	.00	LR	.01	.00	.00	.00	.00	.00	.01	.01	.02	.01	.01	.00
2300	.00	LR	.01	.01	.00	.00	.00	.00	.01	.01	.02	.01	.01	.01
2400	.00	LR	.01	.01	.00	.00	.00	.00	.01	.01	.02	.01	.01	.01
0100	.00	LR	.01	.01	.00	.00	.00	.00	.01	.01	.02	.01	.01	.00
3-hr average		0.00		0.13		0.01		0.05		0.05		0.14		0.03
24-hr average		0.00		0.02		0.00		0.01		0.01		0.03		0.01

LR = Lost Record

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Table A-8b
(Continued)
WIDOWS CREEK STEAM PLANT
OBSERVED SO_2 CONCENTRATIONS

December 27-28, 1979

Hour Ending (CDT)	Sulfur Dioxide Concentrations (ppm)													
	Station 15		Station 17		Station 18		Station 20		Station 23		Station 24		Station 25	
	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.
0100	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.01	NE	0.00	0.54	0.35
0200	.00	.00	.01	.00	.00	.00	.02	.02	.00	.00	.10	.00	1.31	.54
0300	.01	.00	.01	.01	.00	.00	.02	.01	.00	.00	.00	.00	1.49	.88
0400	.01	.01	.01	.01	.00	.00	.02	.01	.00	.00	.00	.00	.10	.05
0500	.02	.01	.02	.01	.00	.00	.02	.01	.00	.00	.00	.00	.48	.24
0600	.02	.02	.03	.02	.00	.00	.02	.02	.00	.00	.00	.00	.53	.39
0700	.02	.01	.02	.02	.00	.00	.02	.02	.00	.00	.00	.00	.04	.03
0800	.02	.01	.02	.02	.00	.00	.02	.02	.00	.00	.00	.00	.07	.02
0900	.02	.01	.02	.02	.00	.00	.02	.01	.00	.00	.00	.00	.60	.34
1000	.01	.01	.02	.01	.04	.01	IM	IM	.00	.00	.00	.00	1.77	.48
1100	.01	.00	.01	.01	.03	.02	IM	IM	.01	.00	.02	.01	.03	.01
1200	.01	.00	.01	.01	.03	.02	IM	IM	.01	.00	.02	.01	.03	.01
1300	.00	.00	.01	.01	.08	.04	IM	IM	.00	.00	.01	.00	.12	.06
1400	.00	.00	.01	.01	.07	.05	IM	IM	.00	.00	.01	.01	.12	.03
1500	.00	.00	.01	.01	.03	.01	.17	LR	.00	.00	.04	.02	.02	.01
1600	.00	.00	.01	.01	.01	.01	.00	LR	.00	.00	.02	.01	IM	IM
1700	.00	.00	.01	.01	.01	.01	.00	LR	.00	.00	.00	.00	IM	IM
1800	.00	.00	.01	.01	.01	.01	.00	LR	.00	.00	.00	.00	.00	.00
1900	.00	.00	.01	.01	.01	.00	.00	LR	.00	.00	.00	.00	.00	.00
2000	.00	.00	.01	.01	.01	.00	.00	LR	.00	.00	IM	IM	.00	.00
2100	.00	.00	.00	.00	.01	.00	.00	LR	.00	.00	.00	.00	.11	.01
2200	.00	.00	.01	.01	.00	.00	.00	LR	.00	.00	.00	.00	.00	.00
2300	.00	.00	.01	.01	.00	.00	.00	LR	.00	.00	.00	.00	.00	.00
2400	.00	.00	.01	.01	.01	.00	.00	LR	.00	.00	.00	.00	.00	.00
0100	.00	.00	.01	.01	.00	.00	.00	LR	.00	.00	NE	NE	.00	.00
Max 3-hr average		0.01		0.02		0.04		0.02		0.01		0.09		0.59
Max 24-hr average		0.00		0.01		0.01		0.00		0.00		0.01		0.15

IM = Instrument maintenance
LR = Lost record

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Appendix B

SO_2 Emissions Data

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Table B-1

SULFUR DIOXIDE EMISSION INVENTORY DATA
FOR SO_2 POINT SOURCES IN THE VICINITY
OF WIDOWS CREEK STEAM PLANT

Source Name	UTM Source Location (km)		SO_2 Emission Rate (g/sec)	
	Easting	Northing	Allowable	Actual
Mead Corporation	610.9	3858.6	54	NA
Penn-Dixie Cement Corporation	615.6	3873.6	56	NA
Widows Creek Steam Plant (TVA)	614.0	3860.7	3010	4326.0

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Table B-2

WIDOWS CREEK STEAM PLANT
PLANT GENERATION

Date	Units On-Line	Average Generation (MW)[a]	Percent of Capacity[b]
April 30, 1979	1, 2, 3, 5, 6, 7, 8	1418	77
July 1, 1979	1, 4, 7, 8	663[d]	36
July 27, 1979	1, 2, 4, 5, 6, 7, 8[c]	1205	65
July 30, 1979	1, 2, 4, 5, 6, 7, 8	586	32
August 15, 1979	1, 2, 7, 8	677	37
November 18, 1979	3, 4, 5, 7, 8	758	41
December 27, 1979	3, 4, 7, 8	620	34

a. Average generation during period of high SO_2 concentrations

b. Capacity =
Unit 1:	135 MW
Unit 2:	135 MW
Unit 3:	135 MW
Unit 4:	135 MW
Unit 5:	130 MW
Unit 6:	130 MW
Unit 7:	525 MW
Unit 8:	525 MW
Total =	1850 MW

c. Unit #4 came on line at 0800 CDT on July 27, 1979

d. Generation reduced during period of high SO_2 concentrations in response to SDEL program

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Table B-3

WIDOWS CREEK STEAM PLANT
COAL ANALYSIS AND SO_2 EMISSIONS

Units 1-6:

Date	Coal Burned (ton)	Sulfur (%)	Btu/lb	SO_2 Emissions[a] ton/day	g/sec	lbs/10^6 Btu
April 30, 1979	5579	0.6	11,757	64	672	1.0[b]
July 1, 1979	1267	0.7	12,206	17	179	1.1
July 27, 1979	4782	0.7	12,331	64	672	1.1
July 30, 1979	5369	0.7	12,331	71	746	1.1
August 15, 1979	1050	0.8	12,275	16	184	1.2
November 18, 1979	2270	0.8	12,107	35	368	1.3
December 27, 1979	2164	0.8	11,886	33	347	1.3

a. Assumes 95% of sulfur evolves as SO_2
b. Emission rate under TVA Consent Decree is 1.8 lbs/10^6 Btu.

Unit 7:

Date	Coal Burned (ton)	Sulfur (%)	Btu/lb	SO_2 Emissions[a] ton/day	g/sec	lbs/10^6 Btu
April 30, 1974	5082	2.6	11,520	251	2636	4.2[b]
July 1, 1979	2942	3.3	11,980	184	1932	5.2
July 27, 1979	3389	2.8	11,700	180	1890	4.5
July 30, 1979	2733	2.8	11,700	145	1523	4.5
August 15, 1979	3202	3.8	11,520	231	2426	6.3
November 18, 1979	3510	2.6	12,010	173	1817	4.1
December 27, 1979	3073	1.9	12,190	111	1166	3.0

a. Assumes 95% of sulfur evolves as SO_2
b. Emission rate under TVA Consent Decree is 6.5 lbs/10^6 Btu.

Unit 8:

Date	Coal Burned (ton)	Sulfur (%)	Btu/lb	SO_2 Emissions[a] ton/day	g/sec	lbs/10^6 Btu
April 1, 1979	4820	3.9	11,420	54	567	1.0[b]
July 1, 1979	3116	3.9	11,840	35	368	0.9
July 27, 1979	3458	3.7	11,570	36	378	0.9
July 30, 1979	2018	3.7	11,570	21	221	0.9
August 15, 1979	4876	4.2	11,630	58	609	1.0
November 18, 1979	2948	3.7	11,600	31	326	0.9
December 27, 1979	213	3.2	11,940	2	21	0.8

a. Assumes 95% of sulfur evolves as SO_2
Assumes 85% removed efficiency of unit 8 scrubber
b. Emission rate under TVA Consent Decree is 1.2 lbs/10^6 Btu.

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Appendix C

Meteorological Data

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METEOROLOGICAL SUMMARY

The meteorological records used in this summary consist of surface and upper air data collected by both the National Weather Service (NWS) and TVA. Figures C-1 through C-7 are surface and upper air charts for the days involved. Tables C-1 through C-7 are meteorological tower data during the period of high SO_2 concentrations. A summary of the meteorological conditions for each excess period is included below.

April 30, 1979

A low pressure system was centered over the Great Lakes area at 0600 CST. A cold front extended through Ohio, Kentucky, and Tennessee into northwest Alabama. At 0430 CST a surface-based inversion extended to about 360 m above the surface. Inversion breakup began by 0800 CST with the inversion completely eliminated by 1200 CST. Winds, during the period 0600-0900 CST, were generally from the northwest at speeds less than 6 meters per second (throughout the layer 300-1900 m above surface). Skies were clear throughout the pre-noon hours.

July 1, 1979

A low pressure system was located over lower Michigan at 0700 CST with a stationary front extending to the northeast and a cold front extending through Pennsylvania, Maryland, and Virginia; then along the Atlantic and Gulf Coasts through the Carolinas, Georgia, Alabama, and Mississippi becoming stationary and swinging northwest. At 0445 CDT, a surface-based inversion extended to about 360 m above the surface. Inversion breakup began by 0800 CDT, with the inversion completely eliminated by 1000 CDT. Winds, during the period 0600-0900 CDT, were generally from the southwest at speeds ranging from near calm at 10 m to almost 10 m/sec at 1500 meters. Skies were clear during the pre-noon hours.

July 26-28, 1979

A low pressure system was located over western Maine at 0700 CDT on July 27, 1979. A cold front extended south from this low over Long Island, then becoming stationary and extending westward to a second low pressure centered over Wisconsin. During the period 1600 CDT on July 26, 1979 through 0100 CDT on July 27, 1979, skies were generally overcast, effectively preventing formation of nocturnal surface-based inversions and somewhat restricting solar radiation and normal diurnal atmospheric mixing. Winds, during the same period, were generally from the southwest at speeds less than 10 m/sec throughout the layer from surface to 1500 m.

July 30, 1979

A low-pressure system was centered over eastern Nebraska at 0700 CDT, with a warm front extending from eastward through Iowa and Wisconsin, then curving southeastward through Indiana, Ohio, Kentucky, Virginia, and the Carolinas. A high-pressure system was centered over southern Mississippi. At 0354 CDT, a surface-based inversion extended to about 360 m above the surface. Inversion breakup began by 0700 CDT with the inversion completely eliminated by 1151 CDT. Winds, during the period 0400-0700 CDT, were generally from the

north in the layer from the surface to 300 m above the surface, and from the northwest from 300 m to 1500 m above the surface. Wind speeds were generally less than 3 m/sec. Skies were clear until about 0800 CDT becoming mostly cloudy to overcast after mid-morning.

August 15, 1979

At 0700 CDT, a cold front extended through Arkansas, Tennessee, and North Carolina; high-pressure was centered over northern Minnesota and off the Carolina coast. At 0427 CDT, a surface-based inversion extended to about 360 m above the surface. Inversion breakup began by 0700 CDT with the inversion completely eliminated by 1228 CDT. Winds, during the period 0300-0600 CDT, were generally from the north at speeds up to 8 m/s in the layer from surface to to 1500 m above surface. Skies were clear throughout the morning hours.

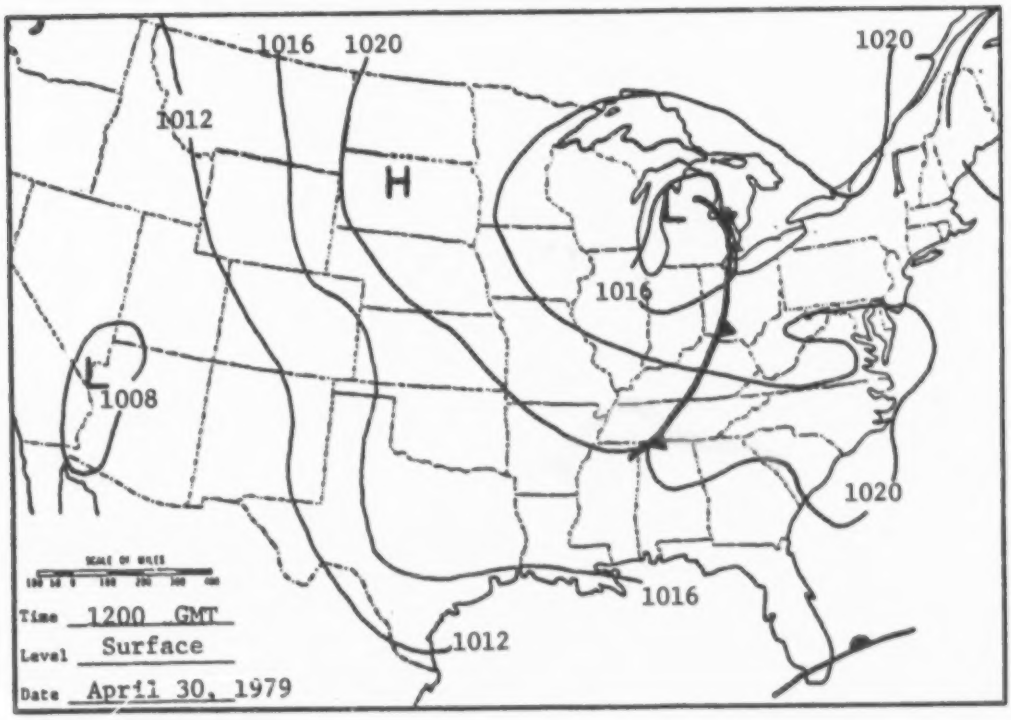
November 18, 1979

At 0700 CST, a combination stationary/cold front extended from northern Minnesota and upper Michigan, through New York, and into the Atlantic ocean at Cape Cod. A high-pressure ridge extended from Kentucky to just south of the Florida panhandle. At 0809 CDT, a surface-based inversion extended to about 550 m above surface. Inversion breakup began about 0800 CST, with the inversion completely eliminated by 1227 CST. Winds were generally from the northeast at 0800 CST, shifting to from the southwest by 1100 CDT, at speeds less than 4 m/sec. Skies were generally clear to partly cloudy all day.

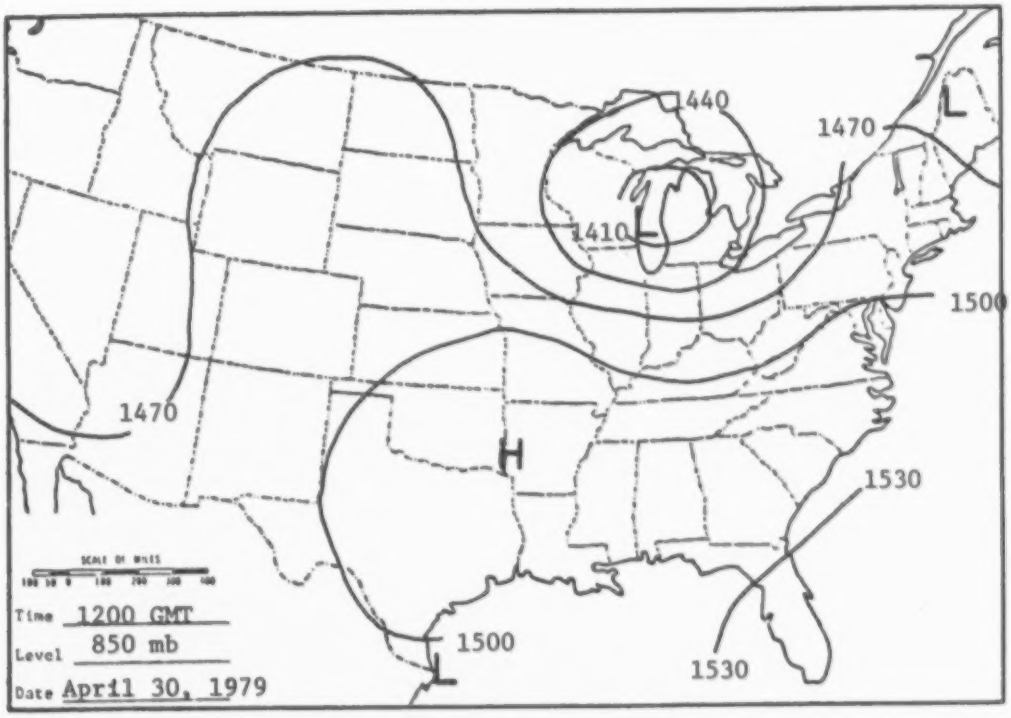
December 26-28, 1979

At 0700 CDT on December 27, 1979, a low-pressure system was centered northeast of Maine, with a high-pressure ridge extending from the Oregon/Idaho region into the upper Midwest. During the period 1100 CST on December 26, 1979 through 0100 CST on December 28, 1979, skies ranged from clear to overcast. Because of overcast sky, no nocturnal inversion existed above 61 meters (tower top) during the evening of December 25-26, 1979. A strong surface-based inversion extended to 550 m above surface at 0842 CST on December 27, 1979 with another inversion extending from about 600 m to 1400 m above the surface. The low-level inversion never completely broke-up during the day as inversion breakup extended as high as 300 m by 1224 CST when overcast skies developed. Winds were generally from the northeast through all day on December 27, 1979. Speeds were up to 11 m/sec in the lowest 1500 m layer.

Figure C-1. April 30, 1979; 0600 CST



Surface Analysis



850 mb (~ 1500 m) Analysis

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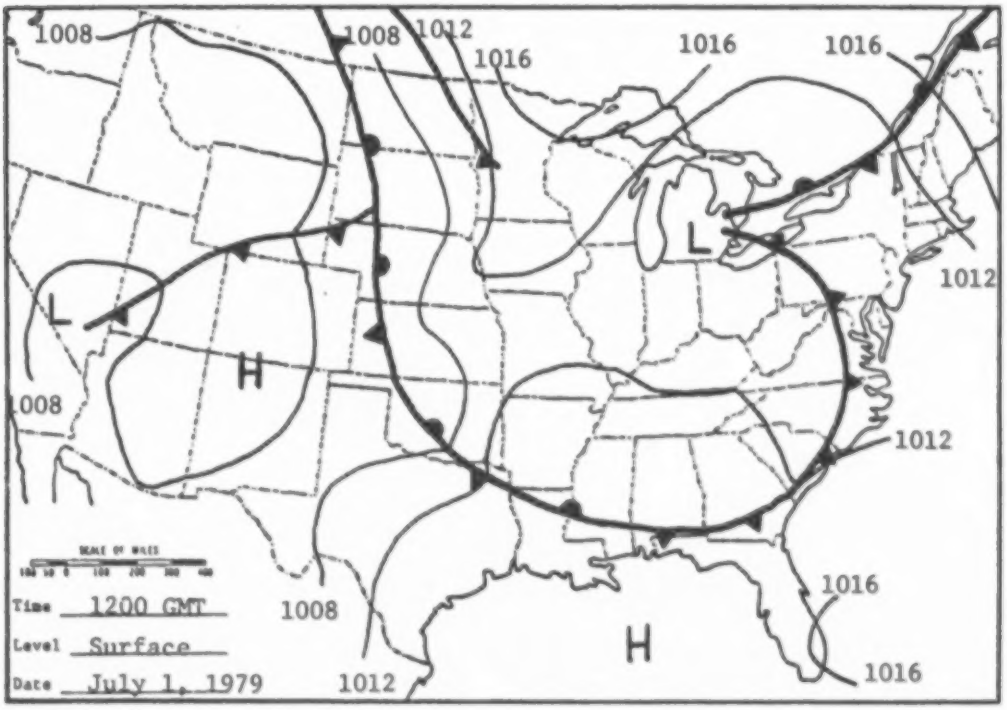
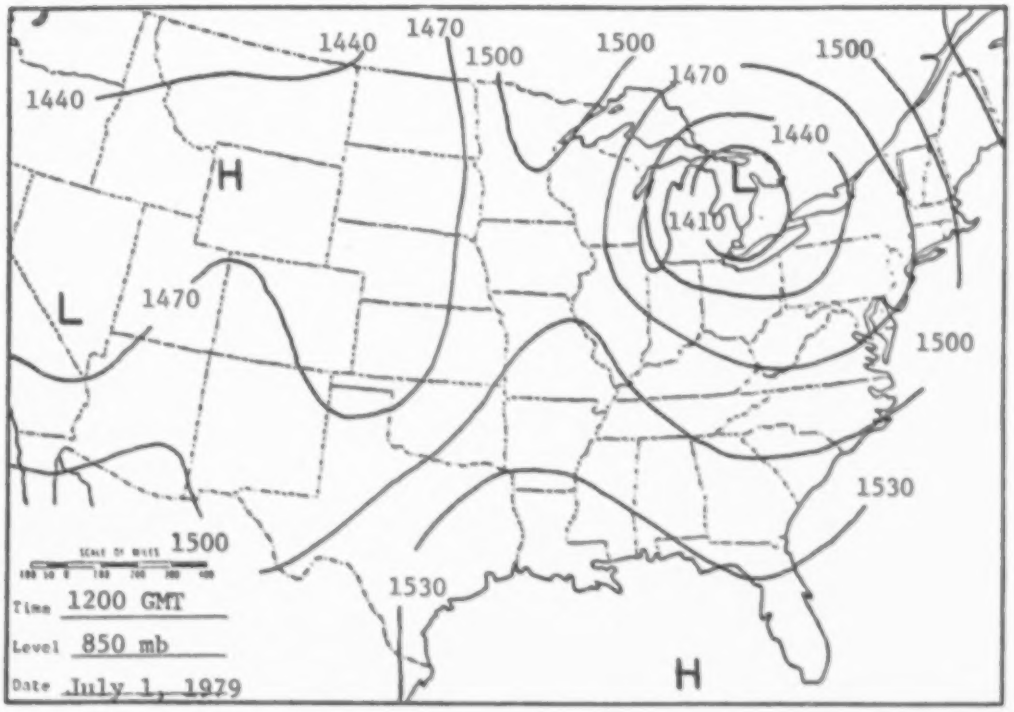
Figure C-2. July 1, 1979; 0700 CDT



Surface Analysis



850 mb (~ 1500 m) Analysis

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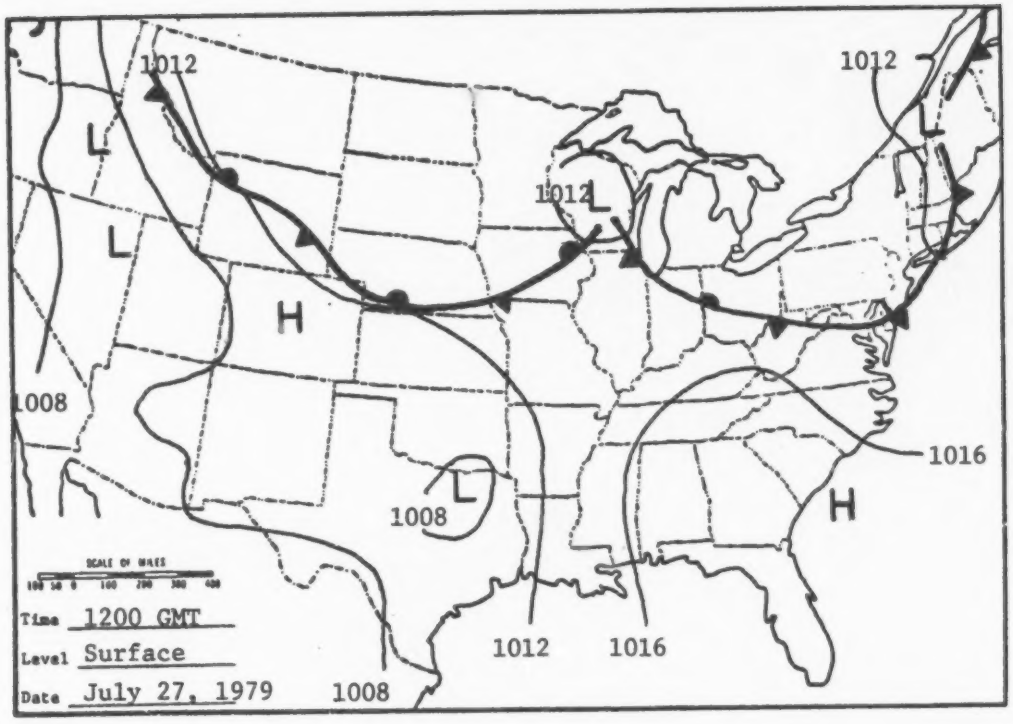
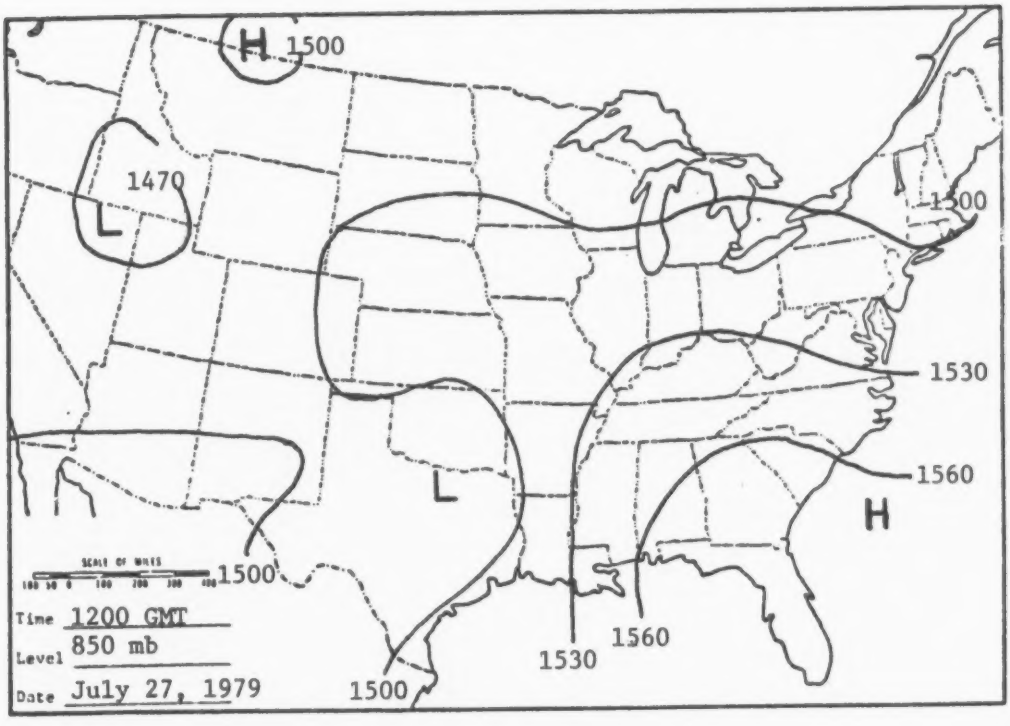
Figure C-3. July 27, 1979; 0700 CDT



Surface Analysis



850 mb (~ 1500 m) Analysis

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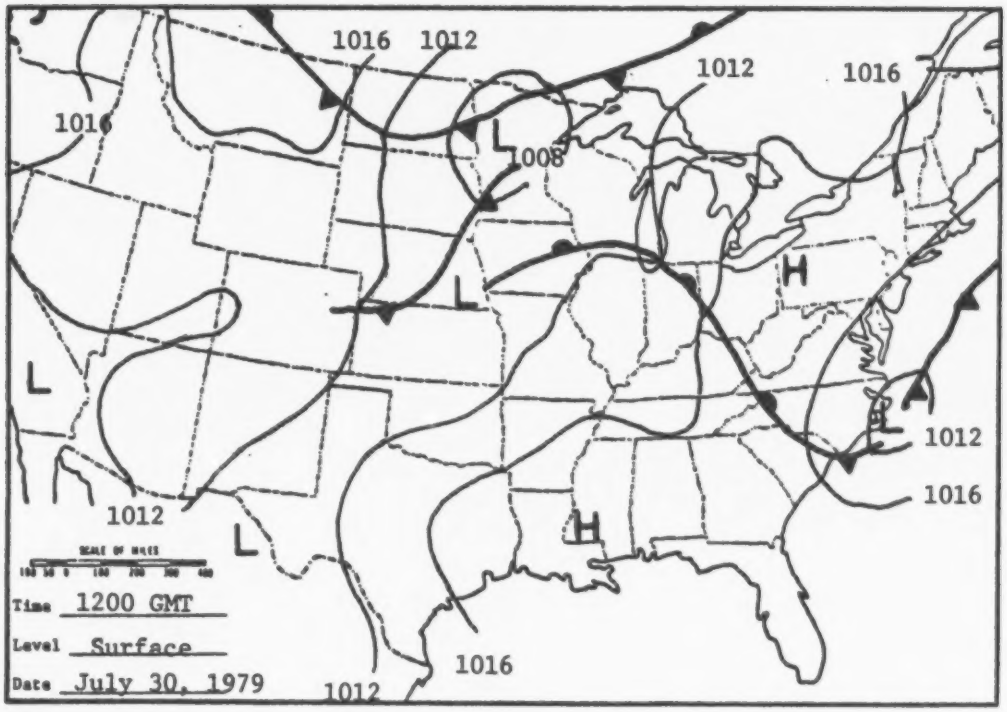
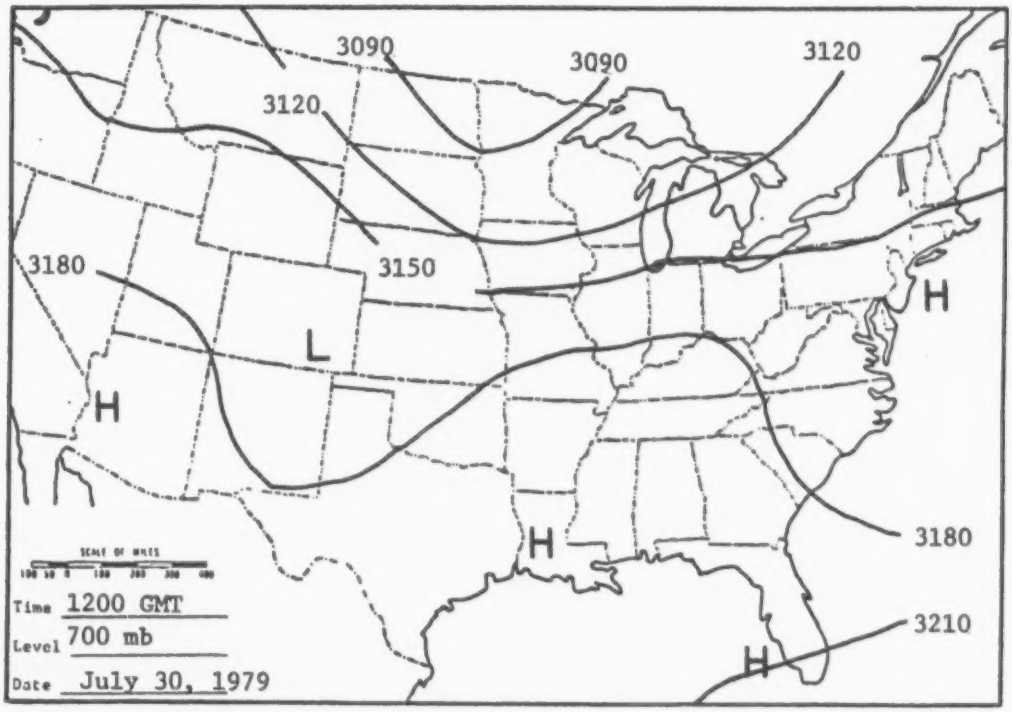
Figure C-4. July 30, 1979; 0700 CDT



Surface Analysis



700 mb (~3000 m) Analysis

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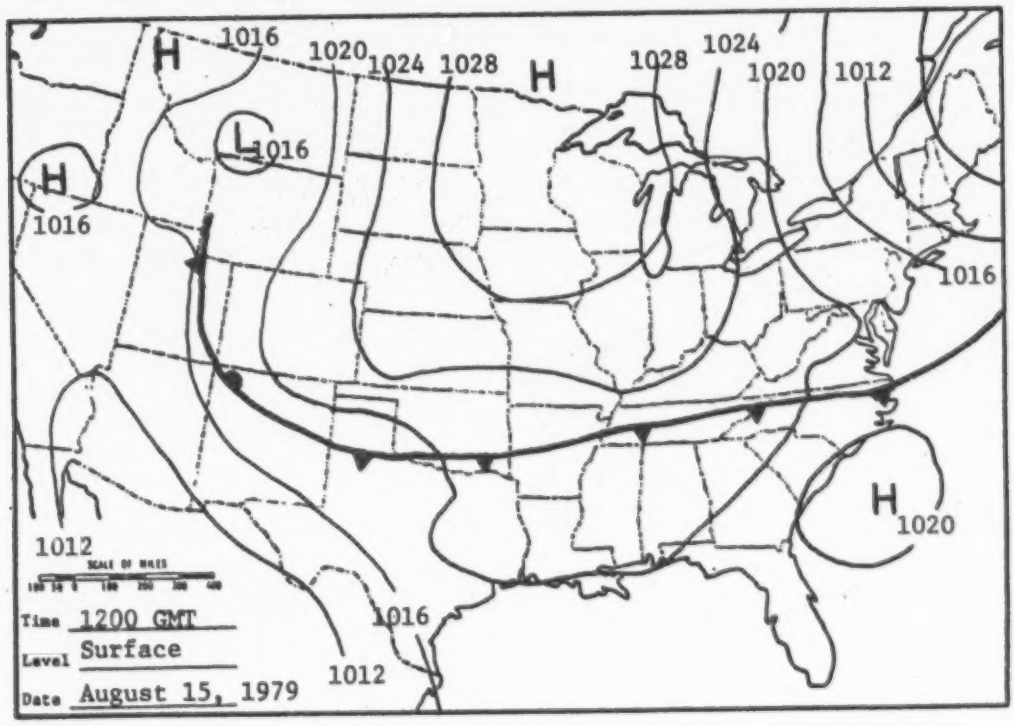
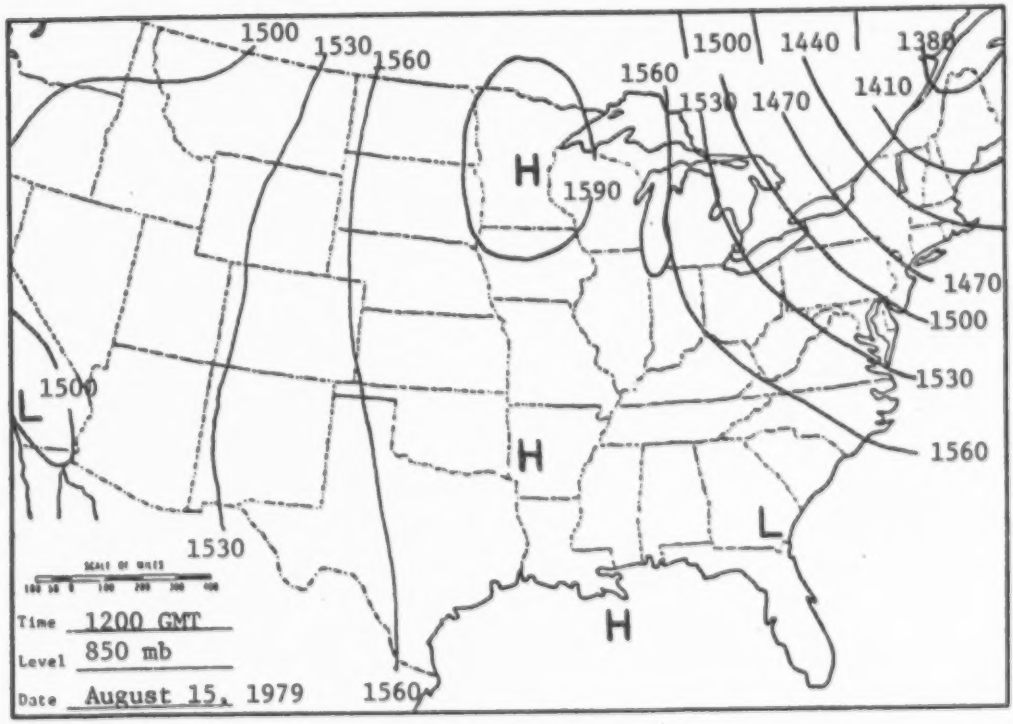
Figure C-5. August 15, 1979; 0700 CDT



Surface Analysis



850 mb (~ 1500 m) Analysis

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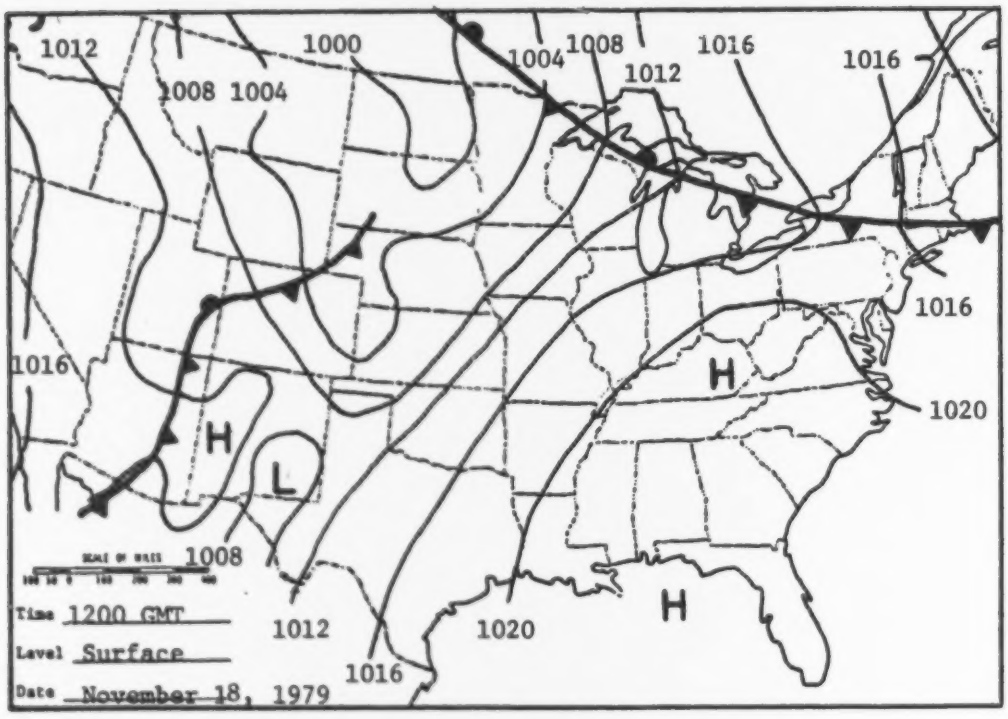
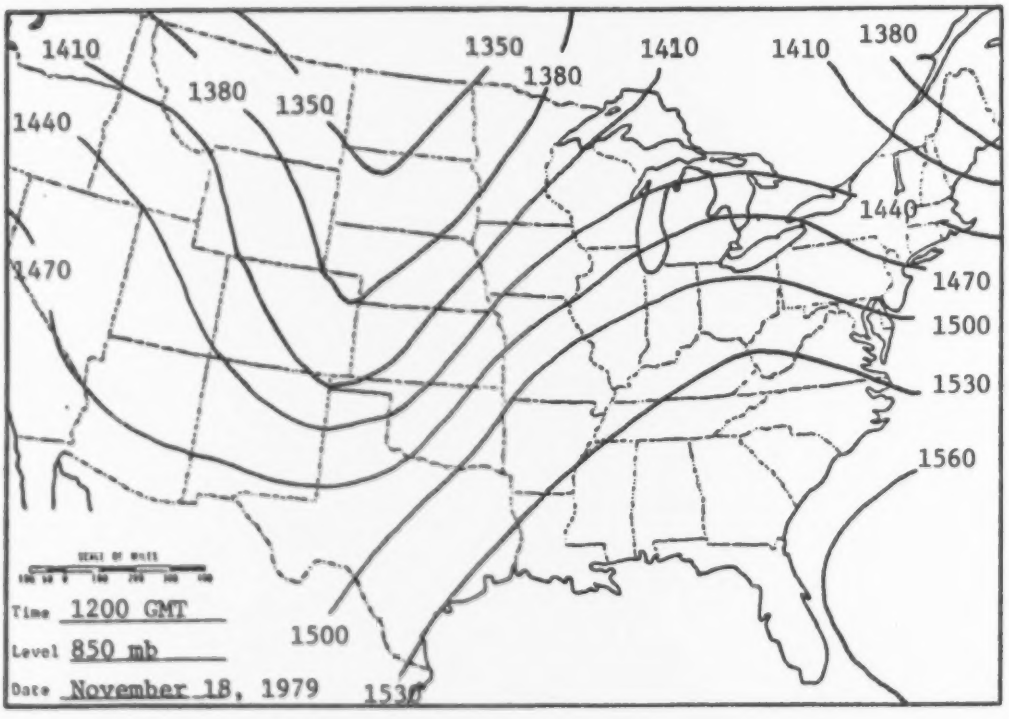
Figure C-6. November 18, 1979: 0600 CST



Surface Analysis



850 mb (~1500 m) Analysis

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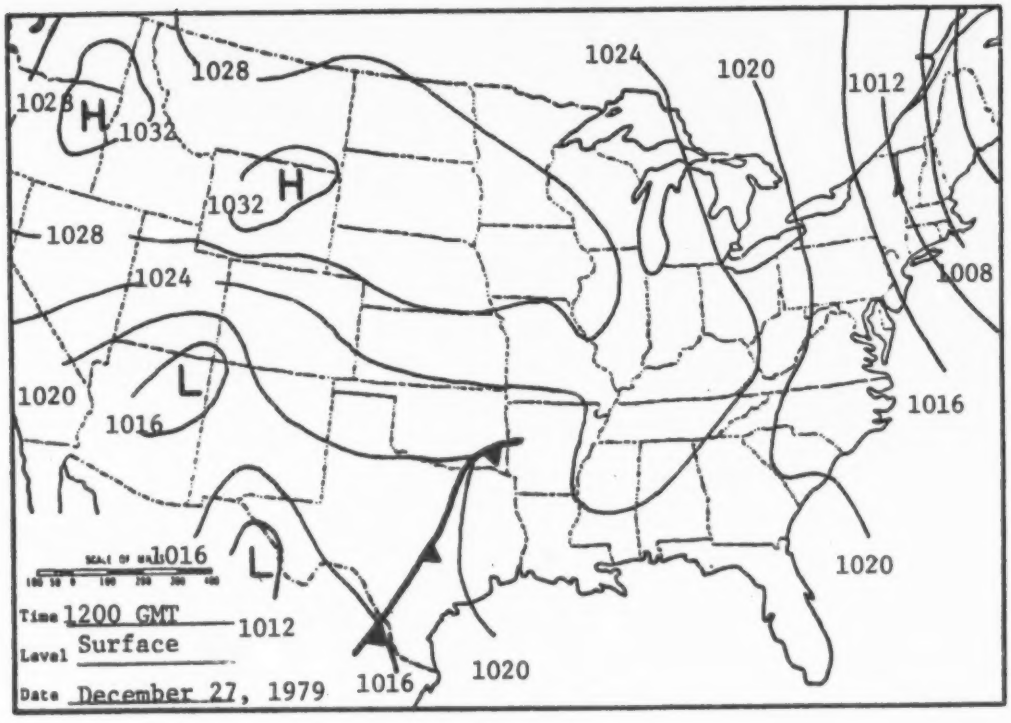
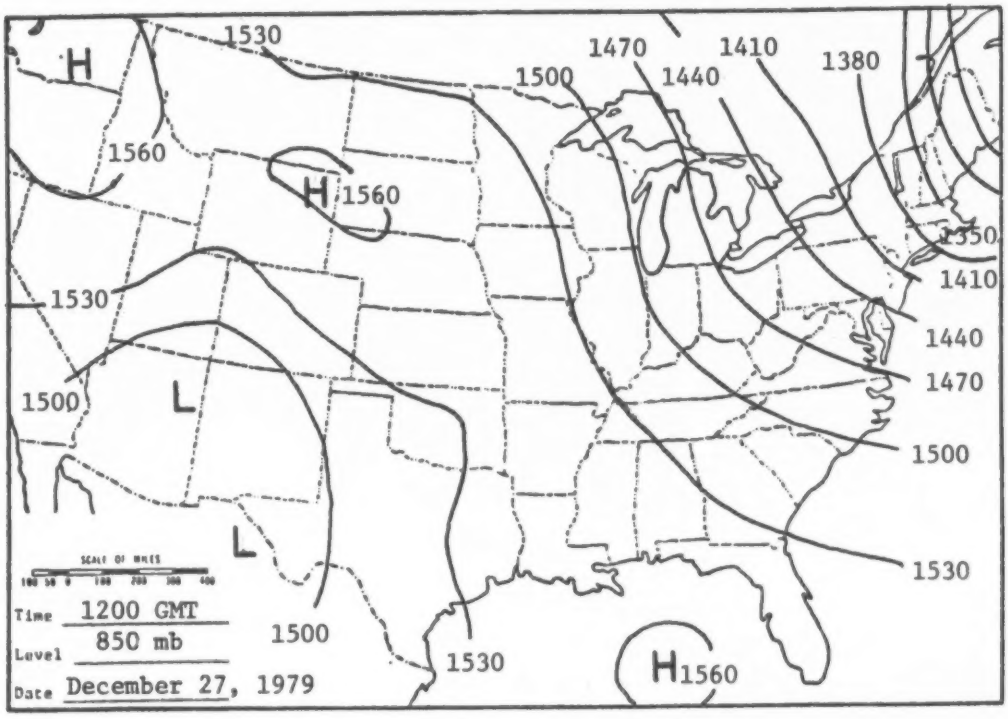
Figure C-7. December 27, 1979: 0600 CST



Surface Analysis



850 mb (~1500 m) Analysis

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Table C-1a

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

April 30, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
0100	1.7	48	93	1.2	11	62	9.4	LR	5.7	0.00
0200	1.8	43	84	1.3	20	62	8.6	LR	5.5	.00
0300	1.8	209	42	0.8	257	43	7.8	LR	4.9	.00
0400	1.8	45	56	1.5	17	43	8.0	LR	4.7	.00
0500	2.3	34	80	1.4	4	64	7.1	LR	4.6	.00
0600	2.3	45	89	0.9	341	41	6.6	LR	4.0	.00
0700	1.8	37	57	1.2	4	67	6.2	LR	4.4	.08
0800	1.9	28	46	1.5	0	65	6.8	LR	7.3	.36
0900	1.6	49	31	1.3	38	17	9.4	LR	10.5	.69
1000	0.8	181	18	1.2	136	41	12.4	LR	13.7	.98
1100	1.2	142	41	1.5	136	38	15.9	16.6	17.3	1.16
1200	1.6	137	37	1.7	140	37	18.5	19.3	20.0	1.35
1300	2.0	80	31	1.7	124	25	19.6	20.3	20.9	1.27
1400	2.0	106	31	1.8	129	27	20.4	21.2	21.7	1.27

LR = Lost record

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Table C-1b

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

April 30, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
0100	1.1	113	91	0.6	242	63	13.2	7.1	3.3
0200	0.8	101	80	0.9	262	82	12.6	6.2	2.9
0300	2.5	220	67	0.7	264	56	12.3	6.1	2.8
0400	1.9	224	57	0.3	269	100	12.3	5.3	2.3
0500	1.3	296	83	0.6	268	89	12.1	4.9	2.2
0600	1.4	311	63	0.4	276	81	11.9	5.8	3.3
0700	1.6	317	74	0.5	348	48	11.8	10.6	9.8
0800	2.7	287	48	1.9	260	33	13.9	14.6	14.7
0900	NF	NF	NF	NF	NF	NF	NF	NF	NF
1000	3.3	314	46	2.5	315	32	14.8	15.6	16.1
1100	2.9	341	39	2.4	344	38	15.6	16.6	17.2
1200	2.8	341	37	2.1	345	23	16.5	17.6	18.1
1300	3.3	345	34	2.5	345	32	17.4	18.3	19.1
1400	2.9	31	19	2.3	29	22	18.1	19.1	19.7

NF = Not found (by computer)

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Table C-2a

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

July 1, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
0100	0.7	75	45	0.6	352	75	18.9	17.2	15.3	0.00
0200	0.4	78	72	0.6	313	64	17.6	16.3	14.4	.00
0300	0.6	195	61	0.6	308	70	16.9	15.6	13.9	.00
0400	1.8	209	61	0.9	347	33	16.3	15.6	13.4	.00
0500	2.4	215	75	0.8	322	38	16.0	15.1	13.2	.00
0600	2.0	55	51	1.6	21	41	15.7	14.8	13.8	.01
0700	1.0	169	32	0.8	332	36	15.7	14.9	14.9	.12
0800	1.3	241	47	0.9	342	29	16.9	17.1	17.3	.33
0900	3.2	230	68	2.2	230	37	19.7	20.4	20.9	.66
1000	3.9	212	78	2.7	191	35	22.1	23.2	23.8	.94
1100	4.0	207	85	2.8	186	44	24.2	25.3	26.1	1.11
1200	3.6	212	42	2.5	205	22	26.3	27.2	28.1	1.04
1300	5.5	283	45	3.5	283	30	28.0	28.8	29.6	1.04
1400	5.9	275	52	3.9	281	34	28.7	29.6	30.3	1.22

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Table C-2b

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

July 1, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
0100	3.0	294	89	1.0	283	67	20.9	18.4	NE
0200	3.1	306	70	1.0	289	56	21.2	17.6	NE
0300	3.3	265	100	0.9	258	77	20.8	15.3	NE
0400	4.0	244	88	1.0	262	75	20.6	16.2	NE
0500	5.7	242	95	1.5	254	59	19.4	16.6	NE
0600	5.5	241	90	1.6	254	49	18.1	16.7	NE
0700	5.4	241	97	1.8	247	48	17.4	17.1	NE
0800	4.8	240	84	2.2	240	38	18.7	19.1	NE
0900	4.8	234	83	2.8	235	38	19.9	20.8	NE
1000	4.2	242	63	2.6	240	35	20.8	21.8	NE
1100	4.5	259	55	3.0	247	36	22.4	23.6	NE
1200	4.6	259	54	2.8	249	35	23.9	24.9	NE
1300	5.5	277	45	3.4	252	33	25.2	26.1	NE
1400	6.4	268	56	3.4	253	35	25.8	26.7	NE

NE = Not enough readings to determine value

BEST DOCUMENT AVAILABLE

Table C-3a

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

July 26-28, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation (LY/MIN)
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	
				July 26, 1979						
1600	2.3	217	53	1.7	229	35	26.6	27.3	27.8	0.78
1700	1.8	209	56	1.1	225	31	26.9	27.6	27.9	.50
1800	1.3	204	78	0.6	220	39	27.0	27.2	27.1	.25
1900	1.1	188	74	0.3	146	63	26.7	26.2	25.6	.07
2000	2.1	180	61	0.5	179	53	26.7	25.6	24.9	.01
2100	1.7	199	30	0.6	341	37	26.0	25.3	24.7	.00
2200	4.2	219	60	1.3	242	36	25.6	25.1	24.4	.00
2300	5.5	209	72	2.3	225	39	24.0	24.2	24.0	.00
2400	3.8	228	79	1.5	228	49	23.2	23.3	23.2	.00
				July 27, 1979						
0100	3.4	220	68	1.3	239	38	22.6	22.7	22.6	.00
0200	2.9	236	90	1.2	262	50	22.3	22.3	22.2	.00
0300	2.3	207	58	0.7	182	66	21.9	21.9	21.6	.00
0400	2.6	218	74	0.8	233	45	21.9	21.6	20.9	.00
0500	2.6	223	84	0.5	267	49	21.7	21.6	20.7	.00
0600	2.0	238	84	0.4	204	41	21.4	21.4	20.8	.00
0700	1.8	231	84	0.7	202	50	21.2	21.4	21.3	.03
0800	1.3	226	63	0.8	200	42	21.5	22.1	22.1	.15

BEST DOCUMENT AVAILABLE

Table C-3a (Continued)

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA VALLEY)

July 27, 1979 (Continued)

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperature			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
0900	1.7	211	53	1.0	195	30	22.7	23.2	23.4	.24
1000	3.0	202	72	1.9	197	34	23.8	24.6	24.9	.52
1100	3.5	214	75	2.0	227	38	24.2	25.0	25.4	.41
1200	3.0	214	67	1.9	223	31	25.3	26.2	26.7	.70
1300	3.3	207	74	2.1	209	37	26.5	27.4	28.0	.98
1400	4.3	209	72	2.8	214	36	27.9	29.0	29.8	1.33
1500	4.8	213	85	2.6	221	38	28.0	29.0	29.6	.93
1600	4.6	211	84	2.7	216	41	28.3	29.3	29.9	.97
1700	4.2	208	77	2.3	210	38	28.6	29.5	30.0	.78
1800	3.8	204	86	1.7	218	39	28.6	29.2	29.4	.48
1900	3.0	210	90	1.0	209	49	28.1	28.0	27.7	.18
2000	2.0	187	91	0.4	199	78	27.3	25.7	24.8	.03
2100	1.0	198	66	1.0	38	70	26.0	24.1	23.4	.00
2200	1.8	22	66	0.8	13	24	24.4	23.3	22.6	.00
2300	1.3	27	36	0.6	326	46	23.6	22.7	22.2	.00
2400	1.8	9	56	0.7	15	29	22.9	22.0	21.7	.00
					July 28, 1979					
0100	1.4	19	46	0.6	44	62	22.2	22.0	21.2	.00

BEST DOCUMENT AVAILABLE

Table C-3b

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

July 26-28, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
				July 26, 1979					
1600	3.2	236	43	2.1	233	31	24.7	25.6	26.3
1700	2.7	270	32	1.7	254	33	25.0	25.7	26.1
1800	2.6	199	40	1.3	208	31	24.9	25.3	25.6
1900	2.5	187	87	0.8	173	70	24.7	24.6	24.2
2000	3.8	167	94	1.0	146	63	24.5	23.8	23.4
2100	4.6	181	70	1.1	175	39	24.1	23.5	23.3
2200	5.1	220	53	2.1	212	39	23.6	23.6	23.4
2300	6.1	228	66	2.7	229	39	22.1	22.2	22.2
2400	3.4	226	82	0.9	247	36	21.6	21.5	21.3
				July 27, 1979					
0100	4.5	226	85	1.3	225	39	21.4	21.2	21.1
0200	4.7	235	79	1.7	232	40	21.4	21.3	21.3
0300	4.3	241	81	1.5	245	46	20.9	20.9	20.9
0400	4.8	235	92	1.5	229	46	20.8	20.7	20.0
0500	4.4	236	90	1.2	233	47	20.7	20.4	20.3
0600	4.1	236	88	1.2	222	48	20.7	20.5	20.4
0700	3.9	239	72	1.3	220	49	20.5	20.5	20.5
0800	4.6	236	75	2.1	227	39	21.0	21.4	21.5

BEST DOCUMENT AVAILABLE

Table C-3b (Continued)

METEOROLOGICAL TOWER DATA (MOUNTAIN)

July 27, 1979 (Continued)

Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperature		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
0900	4.1	246	71	2.4	236	39	21.4	22.1	22.5
1000	4.4	239	68	2.4	229	39	22.9	22.6	21.7
1100	4.0	241	60	2.4	229	39	22.7	23.5	24.0
1200	3.9	247	54	2.5	244	35	23.5	24.4	25.0
1300	3.8	239	63	2.5	227	36	24.4	25.5	26.2
1400	4.4	231	44	2.8	223	33	25.8	26.9	27.7
1500	5.0	243	60	3.0	241	36	25.9	26.9	27.6
1600	4.5	231	57	2.7	223	36	26.2	27.2	21.8
1700	4.3	221	55	2.5	218	35	26.4	27.3	27.9
1800	3.1	228	48	1.8	230	31	26.4	27.1	27.4
1900	2.6	232	78	0.9	219	37	25.8	25.8	25.4
2000	2.9	221	88	0.4	223	55	25.6	23.5	22.5
2100	2.4	185	52	0.4	222	96	25.3	21.5	20.5
2200	3.3	164	57	0.4	272	100	24.9	20.6	19.6
2300	4.6	174	83	0.7	273	59	24.6	20.6	19.0
2400	5.2	184	95	0.8	207	38	23.2	21.0	19.2
July 28, 1979									
0100	4.7	201	84	0.9	216	34	22.6	21.0	19.1

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Table C-4a

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

July 29-30, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
2200	2.0	20	62	1.6	63	57	25.9	24.5	23.9	0.00
2300	1.2	16	51	0.8	64	65	24.4	23.6	23.2	.00
2400	1.0	43	30	0.6	67	72	23.5	23.1	22.2	.00
0100	0.8	25	58	0.5	350	43	22.7	22.3	21.7	.00
0200	1.4	18	50	0.7	15	63	21.9	21.7	20.9	.00
0300	1.5	47	57	0.5	354	62	21.6	21.4	20.9	.00
0400	1.1	44	98	0.8	345	43	21.3	21.0	20.6	.00
0500	1.5	43	65	0.8	23	54	20.9	20.8	20.4	.00
0600	1.3	44	55	0.6	0	71	20.6	20.6	20.3	.00
0700	1.2	28	71	0.8	35	35	20.4	20.7	20.8	.03
0800	0.8	56	42	0.7	321	27	20.6	20.9	21.1	.12
0900	1.1	20	28	1.0	21	33	21.1	21.5	21.9	.46
1000	0.9	75	30	1.1	133	25	23.4	24.1	24.5	.79
1100	2.9	204	66	2.2	180	29	25.8	26.7	27.3	.92
1200	4.1	208	80	2.6	202	43	27.2	28.4	29.2	1.27
1300	3.8	208	70	2.3	215	36	28.4	29.3	29.9	.96

BEST DOCUMENT AVAILABLE

Table C-4b

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

July 29-30, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
2200	5.5	240	78	2.1	241	46	22.7	22.5	22.5
2300	6.4	256	83	2.5	246	46	23.0	22.9	22.8
2400	6.1	256	86	2.3	250	45	22.7	22.4	22.4
0100	5.0	266	82	2.0	254	42	22.6	22.4	22.4
0200	5.0	256	88	1.7	247	54	22.2	22.0	21.9
0300	4.3	256	74	1.5	253	51	22.0	21.7	21.5
0400	3.5	255	50	1.5	269	65	22.0	22.1	22.0
0500	3.0	270	59	1.2	262	40	21.9	22.2	22.2
0600	3.0	271	91	1.2	266	54	21.7	21.7	21.4
0700	2.6	258	61	1.0	270	66	21.7	21.8	21.8
0800	2.9	262	74	1.6	262	47	21.9	22.4	22.7
0900	2.5	277	49	1.7	255	34	22.4	23.1	23.4
1000	1.7	290	27	1.3	340	29	22.8	23.4	23.8
1100	2.0	335	38	1.5	347	28	24.0	24.8	25.6
1200	2.5	298	42	1.8	289	26	25.1	25.9	26.8
1300	3.3	314	35	2.2	332	21	25.9	26.8	27.7

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Table C-5a

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

August 14-15, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
2200	1.3	48	45	0.5	312	32	20.9	19.1	17.0	0.00
2300	0.7	56	49	0.4	339	73	19.5	18.2	16.2	.00
2400	1.6	23	48	1.1	16	54	18.5	17.3	15.6	.00
0100	1.4	51	77	0.7	336	45	17.7	16.3	15.3	.00
0200	0.9	137	49	0.7	339	35	17.2	16.2	14.8	.00
0300	1.3	57	70	0.9	358	47	16.7	15.8	14.8	.00
0400	2.0	35	66	0.7	355	65	16.6	15.8	15.2	.00
0500	2.2	37	80	0.9	359	60	16.2	15.4	14.9	.00
0600	1.8	16	68	0.9	329	66	15.7	15.3	15.2	.00
0700	1.7	15	67	0.8	346	56	15.7	15.8	16.0	.02
0800	1.3	354	53	0.9	341	41	15.8	16.2	16.4	.10
0900	1.0	360	21	0.8	311	23	16.7	17.2	17.6	.41
1000	1.1	211	34	1.3	164	25	19.7	20.3	20.9	.82
1100	0.8	113	28	1.2	127	34	22.3	23.0	23.9	1.02
1200	1.3	129	37	1.4	163	38	24.5	25.4	26.2	1.00

BEST DOCUMENT AVAILABLE

Table C-5b

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

August 14-15, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
2200	1.7	1	75	0.6	256	62	21.2	15.9	14.8
2300	0.7	7	100	0.6	268	59	20.9	14.8	13.8
2400	0.8	2	96	0.3	268	100	20.8	14.6	13.2
0100	1.5	3	64	0.5	262	100	20.6	14.2	12.9
0200	1.6	328	63	0.6	255	74	20.2	14.1	12.8
0300	2.5	338	85	0.6	356	99	19.6	14.8	13.0
0400	2.1	352	93	0.8	356	77	19.5	15.5	12.9
0500	1.7	359	97	0.5	316	53	19.5	13.8	12.8
0600	2.1	1	100	0.5	308	63	19.0	13.7	12.6
0700	2.5	1	95	0.6	324	44	18.7	14.1	13.2
0800	2.1	358	87	0.9	27	58	18.2	16.7	16.7
0900	1.6	349	55	1.4	360	48	19.1	19.3	19.8
1000	2.1	3	49	1.7	351	42	20.8	21.4	22.2
1100	2.4	356	48	2.0	356	38	21.8	22.6	23.6
1200	2.5	349	52	2.1	348	38	22.4	23.2	24.1

BEST DOCUMENT AVAILABLE

Table C-6a

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

November 18, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
0300	1.5	39	79	1.0	21	60	5.3	3.4	0.7	0.00
0400	1.6	43	74	0.8	10	49	4.6	3.3	0.3	.00
0500	1.8	49	80	1.1	24	68	4.1	2.9	0.2	.00
0600	1.4	46	79	1.0	21	86	3.6	2.6	-0.2	.00
0700	2.4	38	90	1.5	20	73	3.6	2.3	1.1	.03
0800	1.4	47	74	1.2	21	48	3.9	3.8	3.9	.23
0900	0.9	25	38	1.0	12	25	5.8	6.3	6.8	.47
1000	0.9	70	36	1.4	123	55	8.5	9.1	9.7	.67
1100	1.0	161	31	1.3	127	36	11.7	12.2	12.8	.80
1200	2.3	200	71	2.1	182	39	14.9	15.6	16.4	.85
1300	2.8	200	72	2.3	185	46	17.1	17.9	18.6	.81
1400	3.7	210	67	2.7	212	40	17.9	18.9	19.6	.69
1500	3.0	211	68	2.3	211	38	18.4	19.2	19.7	.48
1600	3.1	219	84	1.9	224	51	18.3	18.8	18.8	.23
1700	3.2	213	97	1.3	223	73	17.4	16.9	14.7	.02

BEST DOCUMENT AVAILABLE

Table C-6b

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

November 18, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
0300	3.0	260	57	0.6	244	60	12.1	7.6	2.2
0400	2.0	288	66	0.5	244	100	11.9	5.5	1.1
0500	2.7	319	98	0.4	257	46	12.3	4.8	0.7
0600	1.3	308	75	0.4	38	100	10.8	4.7	0.4
0700	1.3	40	53	0.4	37	100	11.4	4.6	1.3
0800	1.1	53	97	0.5	236	47	11.7	8.5	6.3
0900	0.5	53	69	0.6	98	38	12.1	12.3	12.6
1000	1.3	48	21	1.3	70	24	13.7	14.3	14.9
1100	2.0	290	26	1.7	357	24	14.5	15.1	15.8
1200	3.2	270	49	2.5	255	34	14.8	15.7	16.3
1300	3.8	257	48	2.7	246	33	15.3	16.4	17.1
1400	3.7	253	50	2.4	243	32	15.8	16.9	17.4
1500	2.5	201	47	1.6	196	26	16.4	17.2	17.6
1600	2.2	220	60	1.3	217	36	16.2	16.7	16.7
1700	2.7	235	84	0.9	246	72	15.4	14.3	11.2

BEST DOCUMENT AVAILABLE

Table C-7a

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

December 26, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
1000	1.8	6	53	1.5	18	39	3.1	3.6	4.0	0.14
1100	1.9	329	36	1.5	326	28	3.6	4.2	4.7	.24
1200	1.9	341	40	1.7	342	33	4.2	4.7	5.3	.35
1300	1.8	14	31	1.6	353	23	4.7	5.4	6.1	.48
1400	1.5	141	25	1.4	137	27	5.6	6.3	6.9	.60
1500	1.9	184	55	1.7	175	45	6.2	6.9	7.5	.43
1600	2.1	263	30	1.5	258	21	6.6	7.1	7.3	.22
1700	3.0	289	60	1.6	292	46	6.0	6.2	5.9	.03
1800	1.5	335	39	0.6	343	42	4.7	4.7	3.7	.00
1900	1.3	346	47	0.7	27	31	3.8	3.6	1.8	.00
2000	2.5	8	40	1.1	37	54	3.1	2.8	0.6	.00
2100	3.0	48	81	1.3	23	52	2.7	1.9	-0.1	.00
2200	3.0	46	63	1.4	12	77	2.3	1.4	-0.6	.00
2300	2.7	41	88	1.3	8	72	1.6	0.6	-1.2	.00
2400	2.1	51	82	0.9	352	94	1.3	0.1	-1.8	.00

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Table C-7a (Continued)

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (VALLEY)

December 27-28, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures			Solar Radiation
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)	(LY/MIN)
0100	2.5	39	88	1.5	13	82	0.6	-0.7	-1.7	.00
0200	2.9	27	54	1.7	5	58	0.4	-0.7	-1.3	.00
0300	2.8	35	73	1.7	8	71	0.1	-1.3	-1.9	.00
0400	3.7	30	86	1.7	360	81	-0.3	-1.5	-1.8	.00
0500	3.2	37	95	1.7	358	85	-0.2	-1.6	-2.1	.00
0600	2.8	35	78	1.0	10	48	-0.2	-1.6	-2.2	.00
0700	2.7	28	84	1.2	24	68	-0.5	-1.4	-2.5	.00
0800	2.7	13	79	0.8	27	38	-0.8	-1.3	-1.6	.12
0900	1.9	25	81	1.1	6	60	-0.2	-0.1	0.1	.28
1000	2.1	31	54	1.7	16	29	1.8	2.4	3.1	.54
1100	2.4	60	49	1.8	72	33	4.4	5.3	5.9	.71
1200	2.5	28	42	1.9	29	32	7.2	8.1	8.7	.66
1300	2.5	57	52	1.9	96	35	8.7	9.6	10.4	.65
1400	0.8	122	48	0.8	126	50	10.1	10.6	11.0	.38
1500	0.8	167	30	0.9	98	37	11.1	11.6	11.9	.32
1600	2.0	348	50	1.2	346	41	11.0	11.3	11.3	.12
1700	2.9	350	79	1.7	1	53	9.8	9.7	9.3	.02
1800	2.9	24	55	1.0	5	37	8.7	8.5	7.4	.00
1900	3.7	42	79	1.7	32	51	7.4	7.4	6.3	.00
2000	4.8	40	72	2.5	37	51	5.8	6.1	5.9	.00
2100	4.8	48	81	2.5	42	49	5.2	5.4	5.3	.00
2200	4.3	46	82	2.1	38	54	4.5	4.7	4.4	.00
2300	4.2	40	83	2.3	35	62	3.8	3.9	3.7	.00
2400	4.9	35	88	2.8	32	61	3.3	3.4	3.3	.00
0100	4.7	33	79	2.6	32	59	2.8	3.1	2.9	.00

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Table C-7b

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

December 26, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
1000	2.7	355	51	1.7	348	47	0.8	1.4	1.8
1100	2.6	329	57	1.8	320	32	1.2	1.9	2.3
1200	2.6	329	42	1.8	316	30	1.7	2.4	2.9
1300	3.2	329	39	1.7	355	36	2.5	3.2	3.9
1400	2.4	326	40	1.7	348	25	3.2	3.9	4.7
1500	2.6	322	34	1.7	323	27	4.0	4.8	5.4
1600	3.6	270	58	1.9	249	46	4.1	4.7	5.0
1700	3.3	275	44	1.2	294	29	3.8	4.0	3.7
1800	3.8	325	88	1.6	311	51	2.8	2.7	1.7
1900	3.8	341	68	1.3	308	52	2.4	1.6	-0.6
2000	4.7	13	71	0.8	8	58	1.7	0.4	-1.7
2100	5.1	21	91	1.7	15	72	0.9	0.4	-0.7
2200	5.8	22	95	0.7	5	56	0.6	-0.3	-1.3
2300	7.7	15	97	1.2	357	52	0.6	-0.5	-1.5
2400	8.1	15	87	1.0	354	60	0.2	-0.7	-1.4

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Table C-7b (Continued)

WIDOWS CREEK STEAM PLANT

METEOROLOGICAL TOWER DATA (MOUNTAIN)

December 27-28, 1979

Hour Ending (CDT)	61-Meter Winds			10-Meter Winds			Air Temperatures		
	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	Wind Speed (M/S)	Wind Direction (DEG)	Persistance (%)	61-Meter (DEG C)	10-Meter (DEG C)	1-Meter (DEG C)
0100	3.1	18	72	0.4	360	85	0.5	-1.2	-3.2
0200	3.0	2	84	0.7	16	46	1.1	-1.3	-3.6
0300	4.6	14	93	1.5	30	66	0.4	-1.2	-2.2
0400	5.7	10	98	1.2	14	64	1.5	-1.1	-2.8
0500	5.0	7	96	1.7	1	56	1.0	0.2	-0.3
0600	4.7	22	91	1.5	28	40	0.4	-0.1	-0.8
0700	3.0	31	93	1.0	39	70	0.4	-0.6	-2.1
0800	4.0	11	66	1.6	340	39	1.1	0.4	-0.7
0900	2.3	10	81	1.6	37	56	0.8	1.5	1.6
1000	2.7	27	68	2.2	47	57	3.2	3.7	4.2
1100	2.6	35	62	2.5	39	58	5.0	5.7	6.6
1200	2.6	1	47	2.2	352	39	6.6	7.3	8.1
1300	3.2	358	51	2.6	349	48	8.2	8.9	9.8
1400	2.4	340	42	1.7	347	35	9.1	9.7	10.2
1500	2.5	302	38	1.7	306	28	9.4	10.1	10.4
1600	3.6	4	72	2.3	348	57	8.9	9.3	9.4
1700	3.3	357	79	2.3	347	73	7.8	8.1	7.8
1800	3.8	8	82	1.8	350	64	6.6	6.7	6.3
1900	3.8	10	78	1.9	352	51	5.2	5.3	4.9
2000	4.7	13	85	1.9	354	49	3.8	3.8	3.7
2100	5.1	11	59	2.5	354	34	2.8	3.1	3.1
2200	5.8	24	76	3.0	23	46	2.3	2.5	2.3
2300	7.7	23	90	3.9	13	55	1.7	1.9	1.8
2400	8.1	21	88	4.0	8	53	1.1	1.3	1.3
0100	7.5	23	87	4.2	13	60	0.5	0.8	0.8

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Appendix D

Calculations

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Table D-1

WIDOWS CREEK STEAM PLANT
ESTIMATES OF GROUND-LEVEL SO_2 CONCENTRATIONS
(Summary of Calculations)

A. Units 1-6

Stack height = 305 meters
Stack gas volume flow (V_f) = 1611 m^3/s
Stack exit temperature (T_s) = 445°K

Date	Monitor No.	Monitor Elev (M-APG)[1]	Stability Class	T^2 (°K)	u^3 (m/s)	H^4 (m)	σy (m)	σz (m)	Q (g/s)	χ^5 (ppm)
4/30/79	11	287	E	287	5	211	146	44	672	0.000
7/1/79	14	287	E	292	5	210	429	81	179	.004
7/27/79	14	287	E	294	6	199	429	81	672	.019
7/30/79	11	287	E	295	2	278	146	44	746	.000
8/15/79	25	261	F	293	3	189	204	41	184	.000
11/18/79	9	266	E	287	2	280	159	46	368	.000
11/27/79	25	261	F	274	5	206	204	41	347	.000

B. Units 7-8

Stack height = 152 meters
Stack gas volume flow (V_f) = 649 m^3/s
Stack exit temperature (T_s) = 386°K

Date	Monitor No.	Monitor Elev (M-APG)[1]	Stability Class	T^2 (°K)	u^3 (m/s)	H^4 (m)	σy (m)	σz (m)	Q (g/s)	χ^5 (ppm)
4/30/79	11	287	E	288	2	38	146	44	3203	22.020
7/1/79	14	287	E	292	2	37	429	81	2300	3.650
7/27/79	14	287	E	293	3	15	429	81	2268	2.618
7/30/79	11	287	E	295	1	80	140	44	1744	6.637
8/15/79	25	261	F	287	2	35	204	41	3035	15.429
11/18/79	9	266	E	287	2	38	159	46	2143	12.750
12/27/79	25	261	F	272	4	9	204	41	1187	4.240

1. Elevation Above Plant Grade (meters)
2. Estimated temperature at stack top
3. Estimated wind speed at stack top
4. Effective plume height above monitor (based on Brigg's Equations (adjusted for stack height)
5. Estimated ground-level concentration based on Turner's Equations (assumes plume centerline)

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Table D-2

MEAD CORPORATION
ESTIMATES OF GROUND-LEVEL SO_2 CONCENTRATIONS
(Summary of Calculations)

Stack height = 70 meters
Stack gas volume flow (V_f) = 75 m^3/s
Stack exit temperature (T_s) = 330°K
Emission rate (Q) = 54 g/s

Date	Monitor No.	Monitor Elev (M-APG)[1]	Stability Class	T^2 (°K)	u^3 (m/s)	H^4 (m)	σy (m)	σz (m)	χ^5 (ppm)
4/30/79	11	287	C	280	2	0	345	207	0.046
7/1/79	14	287	C	290	1	0	1112	688	.009
7/27/79	14	287	E	294	2	0	552	93	.064
7/30/79	11	287	E	294	2	0	171	48	.403
8/15/79	25	261	F	289	2	0	156	35	.605
11/18/79	9	266	D	282	1	106	343	99	.110
11/27/79	25	261	F	273	4	0	156	35	.303

1. Elevation Above Plant Grade (meters)
2. Estimated temperature at stack top
3. Estimated wind speed at stack top
4. Effective plume height above monitor (based on Brigg's Equations (adjusted for stack height)
5. Estimated ground-level concentration based on Turner's Equations (assumes plume centerline)

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Table D-3

PENN-DIXIE CEMENT CORPORATION
ESTIMATES OF GROUND-LEVEL SO_2 CONCENTRATIONS
(Summary of Calculations)

Stack height = 46 meters
Stack gas volume flow (V_f) = 48 m^3/s
Stack exit temperature (T_s) = 451°K
Emission rate (Q) = 56 g/s

Date	Monitor No.	Monitor Elev (M-APG)[1]	Stability Class	T^2 (°K)	u^3 (m/s)	H^4 (m)	σy (m)	σz (m)	χ^5 (ppm)
4/30/79	11	287	C	280	2	0	1251	776	0.004
7/1/79	14	287	C	290	1	183	784	479	.017
7/27/79	14	287	E	294	2	0	389	77	.114
7/30/79	11	287	E	294	2	0	621	99	.056
8/15/79	25	261	F	289	2	0	512	61	.110
11/18/79	9	266	D	282	1	213	770	168	.024
11/27/79	25	261	F	273	4	0	512	61	.055

1. Elevation Above Plant Grade (meters)
2. Estimated temperature at stack top
3. Estimated wind speed at stack top
4. Effective plume height above monitor (based on Brigg's Equations (adjusted for stack height)
5. Estimated ground-level concentration based on Turner's Equations (assumes plume centerline)

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Table D-4

DOMESTIC HOME HEATING
ESTIMATES OF GROUND-LEVEL SO_2 CONCENTRATIONS
(Summary of Calculations)

Stack height = 2 meters (net height of chimney above sensor probe)
Effective stack height (H) = 2 meters (no plume rise assumed)

Date	Monitor No.	Stability Class	u[1] (m/s)	σy (m)	σz (m)	Q[2] (g/s)	χ[3] (ppm)
4/30/79	11	D	1	8	5	0.1	0.306
7/1/79	14	D	2	8	5	.1	.306
7/27/79	14	E	1	6	2	.0	.000
7/30/79	11	D	1	8	5	.0	.000
8/15/79	25	F	1	4	2	.0	.000
11/18/79	9	D	1	8	5	.1	.306
12/27/79	25	F	1	4	2	.1	.928

1. Estimated wind speed at chimney top
2. Emission assumed only when temperature is less than 20°C
3. Estimated ground-level concentration based on Turner's Equations (assumes plume centerline) at location 100 meters from monitor

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